Volume 044 Article 19

IDAHO

DEPARTMENT OF FISH& GAME

Joseph C. Greenley, Director

FEDERAL AID TO FISH AND WILDLIFE RESTORATION

Job Performance Report

Project F-73-R-1
Fishery Research

SUBPROJECT IV: RIVER AND STREAM INVESTIGATIONS

Study III: Clearwater River Steelhead Investigations

Period Covered: 1 March 1978 to 28 February 1979

by

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September, 1979

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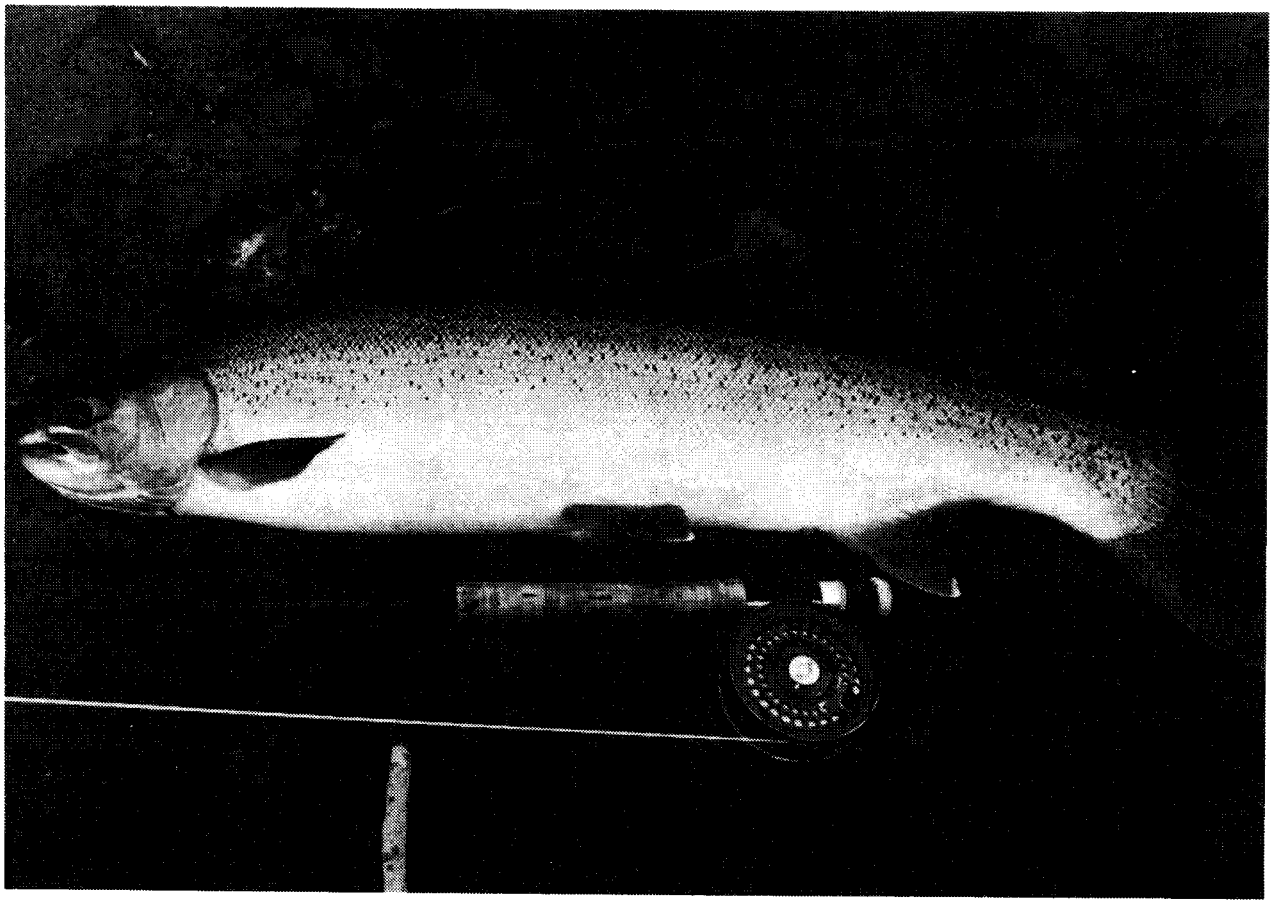

Typical, 1-ocean wild steelhead caught by flyfishermen on the lower Clearwater River, 1977.

ACKNOWLEDGMENTS

We would like to thank Mr. Otto Teller and Mr. Walter Hass for their generosity in providing funds through The American League Of Anglers for the purchase of radio telemetry equipment. Bill Luch of Trout Unlimited provided valuable assistance in securing funding for the hooking mortality investigations on summer steelhead.

Biological aides David Curtis, Brian Magelky and YACC workers Jeff Eacker and Paul Snider contributed their skills and time to the census projects in 1977-1978 and 1978-1979.

JOB PERFORMANCE REPORT

State of Idaho

Name: RIVER AND STREAM INVESTIGATIONS

Project No. F-73-R-1

Title: Clearwater River Steelhead Investigations

Subproject IV

Study III

Period Covered: 1 March 1978 to 28 February 1979

ABSTRACT

This report combines the fall and spring steelhead fisheries on the lower Clearwater River during the fish years 1977-1978 and 1978-1979. It also contains the results of two steelhead investigations which utilized radio telemetry techniques.

Steelhead returns to the Clearwater drainage exceeded 30,000 fish in 1977-78 for the first time since 1962-63. The fishery broke down into an initial 30-day catch-and-release season beginning 15 September and a consumptive season which began in mid-October and continued through 16 April 1978. Anglers spent a combined total of 191,718 hours while catching an estimated 12,857 summer steelhead. This estimate includes 1,453 steelhead released by anglers.

Anglers fishing during the 30-day, catch-and-release season spent an estimated 6,300 hours to release 1,500 steelhead. During the 1977 fall consumptive fishery, fishermen spent 75,200 hours to catch 3,930 fish. Sportsmen released 180 fish during the consumptive season.

During the 1978 spring season, steelheaders spent an estimated 110,200 hours while catching 9,195 fish. This includes 230 steelhead released by anglers.

,The return of adult hatchery steelhead to Dworshak National Fish Hatchery during the 1978 spawning run reached an estimated 12,700. Combined with the sports catch, approximately 26,700 Dworshak steelhead returned to the Clearwater River. Based on the percentage of wild fish in anglers' creels and Snake River dam counts, we estimated that 6,800 wild steelhead returned to the Clearwater for a total run size of 33,530.

Steelhead returns to the Clearwater River reached nearly 16,000 fish in 1978-79. However, due to extremely poor returns of steelhead to the Snake River during July and August 1978, anglers fishing the Clearwater River were restricted to catch-and-release fishing from 30 September through 31 December 1978. When it was determined that a higher than normal percentage of fish crossing the Snake River dams were large, B-run, Clearwater fish, a catch-and-keep steelhead season was initiated on the Clearwater River from 20 January through 30 April 1979.

During the 1978 fall season, anglers participating in the catch-and-release fishery on the lower Clearwater River fished an estimated 9,560 hours to catch and release 2,229 summer steelhead. Nez Perce tribal fishermen fished an additional 1,375 hours to harvest 236 steelhead.

During the 1979 spring season, steelheaders fished an estimated 112,660 hours on the lower Clearwater River to harvest 4,609 summer steelhead. Anglers released an additional 369 steelhead during the spring 1979 consumptive fishery.

The return of adult steelhead to Dworshak National Fish Hatchery totaled 4,940 during the 1979 spawning run. Combined with the sport catch, we estimated that 9,550 Dworshak steelhead returned to the Clearwater River. Based on the percentage of wild fish in anglers creels and on the Snake River dam counts, we estimated that 6,400 wild steelhead returned to the Clearwater River for a total run size of 15,960.

During a radio-telemetry investigation to determine hooking mortality rates on released summer steelhead, workers equipped 15 fish with miniature transmitters during September 1977. Of the 15 released after capture by hook-and-line, only a single individual died as a result of hooking injuries. The remaining transmitter equipped steelhead were monitored for a period ranging between 3 and 174 prior to recapture, returning to Dworshak Hatchery or lost signal.

A second radio-telemetry investigation on the Clearwater during the fall and winter of 1977-1978, attempted to identify and describe straying of adult hatchery steelhead in the Clearwater drainage. Workers captured 12 Dworshak Hatchery fish in the Clearwater which had strayed past the North Fork during November and December 1977. We monitored these transmitter equipped individuals for periods ranging between 45 and 167 days. Although none of the hatchery fish tagged above the North Fork remained upstream or spawned in the upper Clearwater, several individuals moved upstream as far as the Middle Fork. All but a single fish eventually returned back downstream to the North Fork or the hatchery. Most individuals ceased moving when water temperatures dropped belowt3 C (27 F). Periods of intense movement made by radio-equipped fish occurred during high flows associated with turbid water conditions.

From the results of the tracking study, it appears that the practice of releasing Dworshak Hatchery smolts in the main Clearwater may increase the rate of adult bypass. However, the bypass and straying upstream from the North Fork appears only temporary in nature.

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RECOMMENDATIONS

Continue to monitor the Lower Clearwater steelhead returns in 1979-1980. In addition, establish a study to evaluate the success of the Dworshak Hatchery satellite smolt release program at Clear Creek. Approximately 300,000 smolts were released at Kooskia National Fish Hatchery in spring 1978. Returning 1-ocean adults from the release will enter the Clearwater River during the 1979-1980 run.

Reopen the catch-and-release status of the main Clearwater above the Orofino bridge during the fall season. This will be necessary if the satellite smolt program is to be evaluated.

OBJECTIVES

To monitor the survival of adult, summer steelhead trout caught-and-released by fishermen in the Clearwater River during periods when river temperatures remained above 15 C (59 F).

To monitor movement and migratory behavior of adult summer steelhead trout in the lower Clearwater River.

To describe the migratory behavior of hatchery reared adult steelhead which have strayed past the confluence of the North Fork (Dworshak National Fish Hatchery) during the fall migration period and to monitor their spawning movements into Clearwater tributaries during the spring.

To monitor the steelhead sports fishery on the lower Clearwater and to evaluate the returns of hatchery fish to Dworshak National Fish Hatchery and wild steelhead to the upper Clearwater tributaries.

To determine juvenile steelhead densities in selected tributaries of the Lochsa, Selway and South Fork drainages.

TECHNIQUES USED

Angler Creel Census

We conducted a random angler creel census on the lower Clearwater River (Lewiston to Orofino) during the fall and spring steelhead season from 15 September 1977 to 16 April 1978.

During the 7-month steelhead fishery, we made angler counts on one weekend day and one randomly selected weekday during each week for a total of four census days per 2-week interval. Four angler counts, two in the morning and two during the afternoon, were made each census day while driving Highway 12 between Lewiston and Orofino. Steelhead anglers were interviewed during each census trip and during the non-count day of each weekend.

Because of the width of the lower Clearwater River, census personnel are unable to interview steelhead anglers fishing from boats by vehicle along the highway. Boat angler interviews were made by department personnel using an outboard jet powered riversled.

We divided the lower Clearwater River (Lewiston to Orofino) into three census sections: Section 1 - slack water portion of the Clearwater Arm of Lower Granite Reservoir; Section 2 - Old Washington Water Power damsite to Lenore Bridge; and Section 3 - Lenore to Orofino Bridge. Section 4 is the open area of the North Fork Clearwater River below Dworshak Dam (Fig, 1).

We interviewed steelhead anglers between counts and on interview days to determine residence, number of hours fished, method and number of fish caught or released. We measured all steelhead to the nearest 13 mm (1/2 in) and examined fish for fin clips and other external marks. External marks and evidence of fin erosion were used to identify and separate fish of hatchery origin from wild steelhead in the catch.

Computation of Estimates

Fishing effort in hours is the product of average angler counts (4), times the average daylight hours per day during the interval, times the number of days in the 2-week interval. Weekend days and weekdays were calculated separately as were holidays. Effort was partitioned by angling type (boat vs. shore) and between non-tribal and Nez Perce tribal fishermen in 1976. The number of daylight hours used to calculate estimates was based on sunrise-sunset tables of the Nautical Almanac Office, U.S. Naval Observatory. The daily sunrise and sunset times were plotted graphically against dates, and in each 2-week interval, the midpoint values were used to derive the average daylight length.

Radio Tracking of Summer Steelhead Adults

During the 1977-1978 steelhead return to the Clearwater River, we equipped a total of 27 summer steelhead adults with radio-tracking transmitters. We used fish modules specifically developed for steelhead trout and manufactured by Wildlife Materials, Inc., and by AVM Instrument Company. Both manufacturers constructed fish modules of similar size and shape which consisted of either a cylindrical (WFM) or rounded, dorsally-ventrally flattened (AVM)battery pack and transmitter section coupled to a small loop antenna (Fig. 2). Transmitter size varied slightly. We found overall length ranged between 58 and 62 mm (2.2 - 2.4 in) and between 15 and 19 mm (.59 - .75 in) in diameter and thickness. Battery activation procedures differed slightly for the two transmitters used during the investigation. Fish modules manufactured by AVM Instruments required external battery leads to be soldered together and covered with a thin coating of acrylic plastic prior to use. Transmitter preparation was done in the lab several days in advance of anticipated use. Fish modules constructed by Wildlife Materials came equipped with magnetic on-off switches. We activated these transmitters in the field by removing the bar magnet taped to the outside of the module.

We captured all steelhead to be equipped with transmitters by hook-and-line methods. We used fly fishing gear to capture six steelhead and the remaining 21 by trolling hotshots from a drift boat. Captured fish were played to exhaustion, then depending on the angling method, beached on shore or brought into the boat by a landing net. We immediately placed the transmitter module into the steelhead's mouth and forced it past the esophageal sphincter so that it became lodged in the stomach. We used a preshaped, wooden dowel to insert the module, making sure that the antenna entered first. Forcing the transmitter past the esophageal sphincter by pushing on the loop can cause damage to the sensitively tuned antenna. Next, we measured and externally marked the fish by placing a Floy anchor tag at the insertion

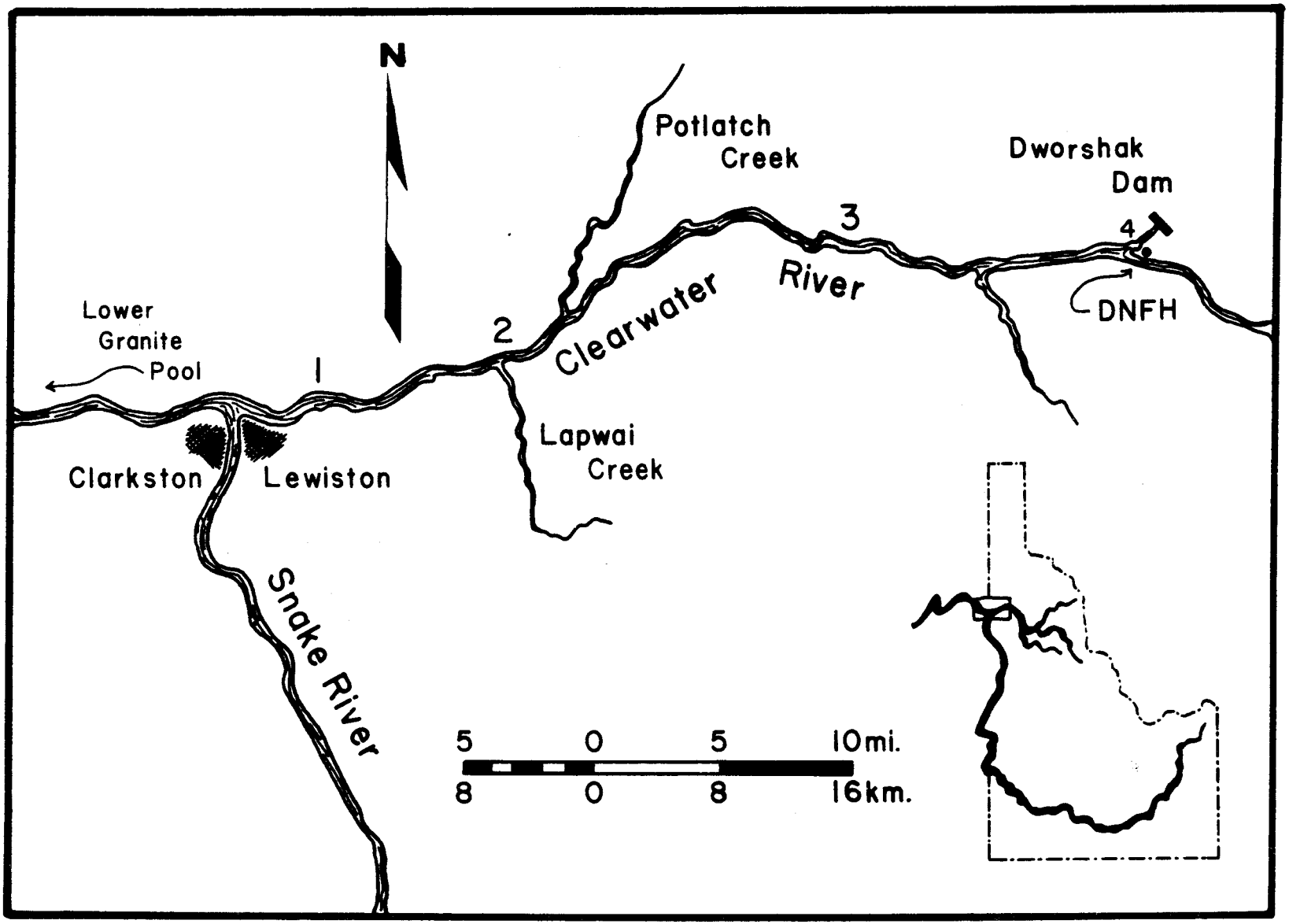

Figure 1. The lower Clearwater River from its mouth to Orofino, Idaho. Numerals indicate the four creel census areas between Lewiston and Orofino.

of the dorsal fin, The entire tagging process took between 20 and 30 seconds, Immediately after releasing the steelhead along shore in areas of reduced current velocity, we verified the transmitter frequency using the receiver and hand-held loop antenna. Both the frequency and transmitter pulse-rate were recorded in a log book along with the location, date and water temperature. We also recorded the length, sex and origin (wild vs. hatchery) of each transmitter equipped steelhead.

We tracked tagged steelhead daily during the first 15 days after release and during periods of rapid movement, During December and January, we reduced tracking frequency to alternate days since colder water temperatures had all but eliminated migration. . We equipped vehicles with permanent antenna stands and mounted 50 MHz Yagi, 3-element antennas on 2.4-m (8-ft) masts. The Yagi antenna allowed us to utilize its directional properties to radio locate migrating or resting steelhead.

Radio location procedure on the lower Clearwater River consisted of driving along Highway US-12 in the tracking vehicle with the antenna set up so that the shortest element (director) pointed towards the river at right angles with the direction of travel. To insure maximum reception, we assembled the antenna with its elements positioned vertically. Because signal saturation tends to occur when the receiver gain control is set too high, workers utilized earphones in order to set gain control at barely audible levels. This practice allowed workers to have maximum directional differences, necessary for accurate radiolocation.

Fish trackers drove along the river at approximately 40 mph with the receiver set to the desired channel and frequency. When a weakly audible signal occurred, vehicle speed was reduced so that the location of the maximum signal intensity could be pinpointed. We then recorded the steelhead's location (river miles) and frequency (fine control). We also recorded the time, date and water temperature and made note of any unusual environmental conditions (flows, turbidity or ice formation).

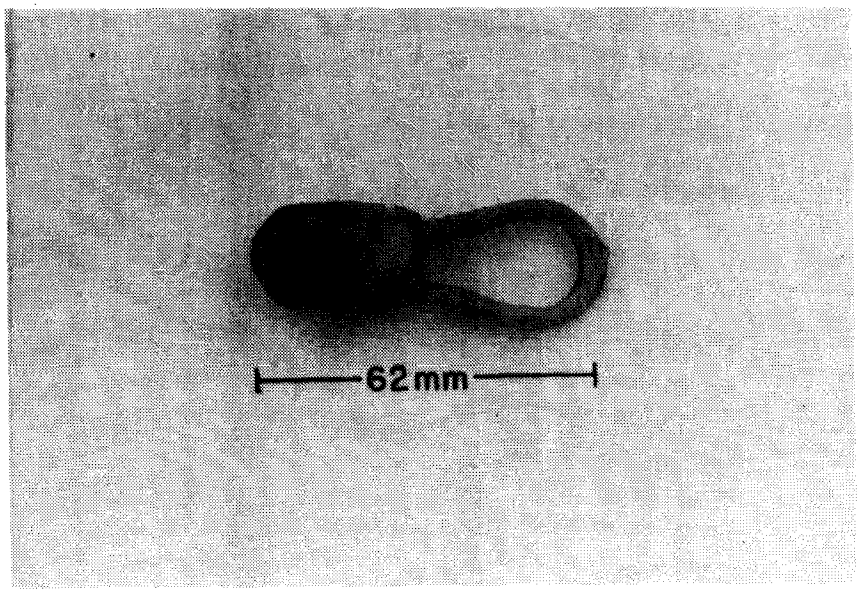

Figure 2. Miniature radio transmitter used to monitor survival and movement of adult, summer steelhead on the Clearwater River.

FINDINGS

1977 Fall Steelhead Fishery

The summer steelhead escapement to the Clearwater River in 1977-1978 approached an estimated 34,000 fish, making it the largest return since 1963. The Idaho Department of Fish and Game established an initial 30 day catch-and-release season beginning 15 September and continuing through 16 October. The purpose of the non-consumptive opening was to allow early arriving wild steelhead to pass through the lower Clearwater prior to a consumptive fishery on a later run of mostly hatchery origin. The Commission originally set a three-fish limit to begin 17 October, but steelhead counts at Ice Harbor Dam by mid-September indicated a more liberal bag limit and the 1977 fall season regulations were amended to allow a total of six fish per angler.

River conditions during the 30 day catch-and-release season remained perfect for steelheaders. The low water levels due to the 1976-1977 drought and an increased escapement of wild steelhead helped provide exceptional catch rates by both shore and boat anglers. We estimated that steelhead fishermen on the lower Clearwater spent approximately 7,200 hours to catch-and-release 1,200 steelhead. Boat anglers spent an estimated 2,530 hours to catch-and-release 608 summer steelhead for an average catch rate of 4.2 hours per fish (Table 1). During the same 30-day period, non-Indian shore fishermen spent 3,780 hours to release an estimated 450 steelhead trout for an average catch rate of 8,3 hours per fish, We estimated Nez Perce tribal members fished 903 hours and caught 137 steelhead, averaging 6.6 hours per fish.

We again found the non-consumptive season typified by reduced numbers of anglers and exceptionally high levels of success. The excellent weather conditions during the first 30 days, which did not continue into the fall season, contributed to the success enjoyed by lower Clearwater steelhead anglers. The increased effort expended by catch-and-release anglers during the second 2-week interval, and their higher success, can be attributed to river flows below Dworshak Dam. The annual period of reduced discharge from the Dworshak project begins 1 October, and steelhead anglers fishing between 15 and 30 September found conditions difficult due to high water levels.

The consumptive fall steelhead fishery began on 17 October and continued through December. Although we expected a significant jump in angling pressure once fishermen could begin harvesting their catch, the increase which did take place illustrated what a 4-year period of fishing closures and restricted, non-consumptive regulations had done to steelheading appetites.

During the first 2-week interval of the catch-and-keep season, anglers fished an estimated 35,300 hours on the lower Clearwater. We estimated anglers caught over 1,400 steelhead (Table 1). During this 2-week period, steelhead anglers spent approximately 3 times more effort than fishermen had spent during both the 1975 and 1976 catch-and-release seasons combined. However, the average rate of success decreased 4-fold, to 25 hours per fish, from the high success enjoyed by catch-and-release anglers during the first part of the 1977 season.

The combined total effort spent by both shore and boat anglers during the 1977 fall steelhead season approached 82,500 hours and easily surpassed the previous high of 58,600 hours spent during the 1972 fall steelhead (Fig. 3). Had the consumptive season begun on 1 October, as **in** previous fall fisheries, we believe anglers

Table 1. Estimated effort, harvest and average catch rates per 2-week interval during the fall steelhead season on the lower Clearwater River, 1977. The estimates for the 30-day catch-and-release period are subtotaled and include estimates for Nez Perce Tribal members

Interval	Shore anglers			Boat anglers		
	Hours	Catch	H/F	Hours	Catch	H/F
15 Sept. to 30 Sept.	1,226 104[a]	135 O[b]	9.1 O[c]	708	106	6.7
1 Oct. to 16 Oct.	2,552 779	319 137	8.0 5.8	1.818	502	3.6
Subtotal	3,778 903	454 137	8.3 6.6	2,526	608	4.2
17 oct. to 30 Oct.	13,614	523 (23)[d]	25.0	21,657	891 (40)[d]	24.3
1 Nov. to 14 Nov.	7,809	241 (44)	27.4	15,092	719 (19)	20.4
15 Nov. to 30 Nov.	2,258	124 (8)	17.1	4,495	281 (14)	15.2
1 Dec. to 14 Dec.	1,014	49 (0)	20.4	1,386	119 (0)	11.7
15 Dec. to 31 Dec.	3,795	408 (17)	8.9	4,131	401 (13)	10.0
Subtotal	28,490	1,345 (92)	19.8	46,761	2,411 (86)	18.7
Grand Total	32,268	1,482 (546)	16.0	49,287	2,411 (676)	16.0

[a]Estimated effort by Nez Perce tribal members during the 30-day C/R season
[b]Estimated Nez Perce tribal harvest
[c]Estimated catch rate by Nez Perce tribal members
[d]Estimated number of steelhead released during consumptive fishery

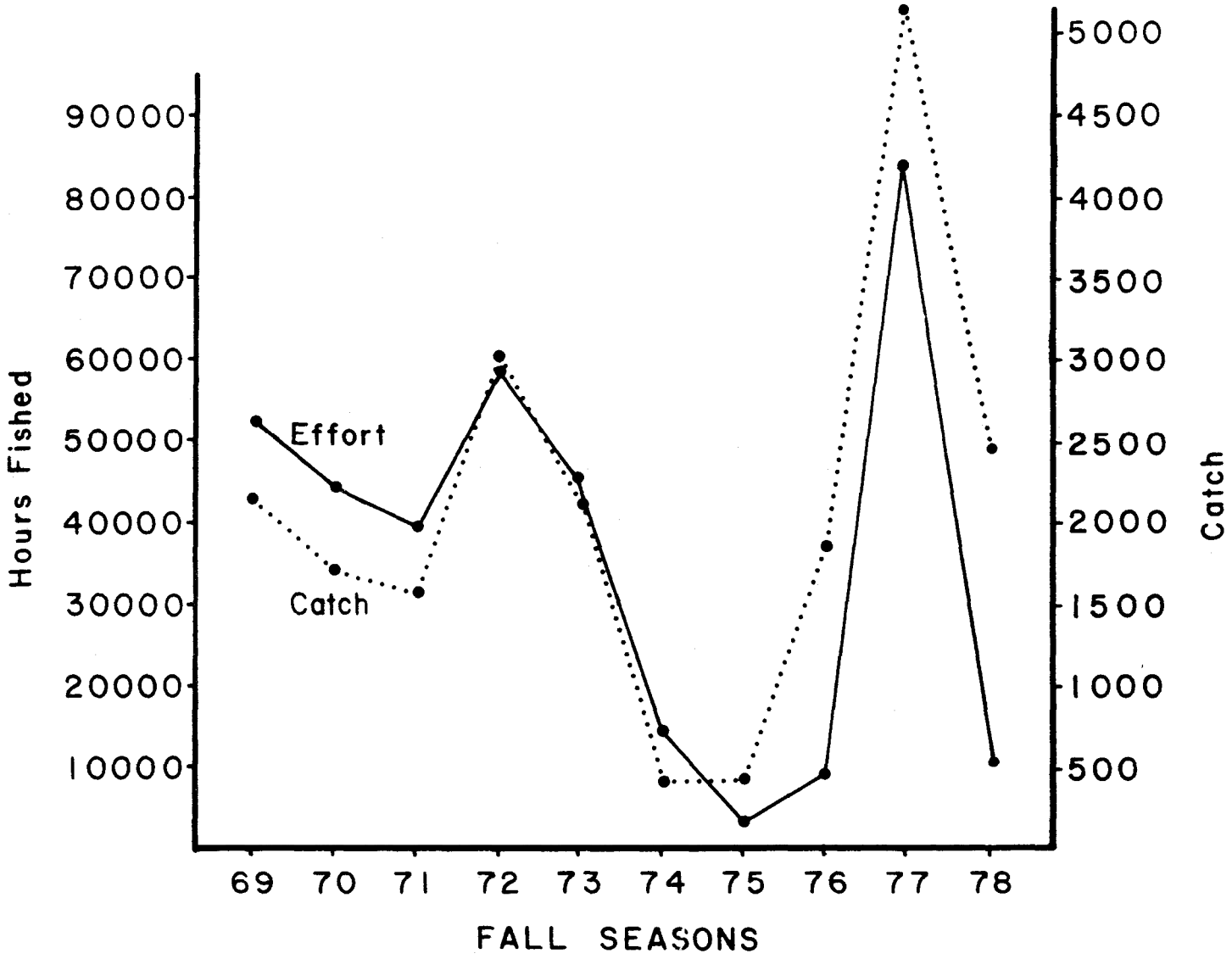

Figure 3. The estimated angling effort (total hours) and catch made by steelhead anglers during the fall seasons on the lower Clearwater. Estimates include both shore and boat anglers from 1969 to 1978.

would have spent more than 100,000 hours of fishing effort. We estimated steelhead anglers caught 5,133 summer steelhead during the entire 1977 fall season (Fig. 3). Census estimates indicated that steelhead anglers released 1,240 fish, or 24% of the season's total catch. The 3,893 steelhead harvested surpassed the 1972 harvest estimates by 23%. Anglers released an estimated 5% of their steelhead after 16 October when catch-and-keep regulations began.

Shore anglers on the lower Clearwater during the 1977 fall season experienced periods of excellent steelhead fishing and took advantage of these conditions to catch a record number of summer steelhead. However, heavy fall rains beginning in mid-November, and continuing through mid-December, caused river conditions to deteriorate and few anglers participated during census intervals 5 and 6 (Table 1). Even with the month of exceptionally high and turbid water conditions, shore anglers caught an estimated 2,028 steelhead in 1977 (Fig. 4). This figure nearly doubled the harvest made in the fall of 1972, when the previous record for shore anglers occurred.

We estimated steelhead anglers fishing from shore spent approximately 33,200 hours to catch the record 2,028 fish, for an average catch rate of 16.4 hours per fish (Fig. 4). Exceptionally high rates of success occurred during the 30-day catch-and-release season, but dropped off to more average success rates when the consumptive fishery began (Table 1). Since river conditions remained good to excellent during census intervals 3 and 4, and more steelhead had naturally entered the Clearwater, it appears that factors other than fishing conditions were responsible for the more than twofold increase in the time necessary to catch a fish. One can only assume that the average of angler skill levels was reduced once the consumptive season started. Another factor which can't be measured is the effect of overcrowding on angling success. Finding a place to fish in most of the traditional fishing spots was difficult during the first month of the consumptive fishery. In addition, conflicts between shore anglers and boat fishermen increased significantly during the same period. It is the author's opinion that the unprecedented number of boats on the lower Clearwater during census intervals 3 and 4 may have reduced angler success by keeping the steelhead population in a state of harassment. We found shore anglers encountered extremely poor conditions from mid-November until mid-December when cooler, drier weather dropped stream levels and reduced turbidity. During the last census interval of the fall season, catch rates increased more than 2-fold. Increased catch rates resulted from a combination of improved river conditions and from higher angler skill levels. We have found that with the onset of mid-winter temperatures, only the dedicated and expert steelhead anglers continue to fish.

During the 1977 fall season, steelhead anglers fishing from the bank accounted for approximately 40% of the total effort (Table 2), We found this percentage the lowest recorded during the 9-year investigation. We estimated bank fishermen caught 35% of the summer steelhead catpured during the fall season. We found this somewhat unusual, since previous census statistics indicated that to catch as high as 35% of the total harvest, shore anglers needed to account for approximately half of the season's fishing effort. During the 10-week consumptive fishery, shore anglers released 6% (92) of their steelhead.

Boat anglers fished an estimated 49,300 hours to catch 3,105 steelhead during 1977, for an average success rate of 15.9 hours per fish (Fig. 4). We observed a similar decrease in catch rates for boat anglers once the catch-and-keep steelhead regulations went into effect. The nearly 5-fold increase in the hours necessary to catch a steelhead after the consumptive fishery began illustrates the effect that overcrowding and higher average angling skills can have on the success rates (Table 1). Steelhead angler's use of boats in 1977 far surpassed any previous use estimates

Table 2. Proportion of total effort and steelhead harvest estimates during fall steelhead seasons, 1969-1978

Year	Percent of effort by		Percent of harvest by	
	Boat anglers	Shore anglers	Boat anglers	Shore anglers
1969	49	51	67	33
1970	50	50	66	34
1971	39	61	42	58
1972	49	51	65	35
1973	66	34	82	18
1974	57	43	68	32
1975*	49	51	55	45
1976*	34	66	42	58
1977	60	40	65	35
1978*	55	45	65	35

*Catch-and-release fishery

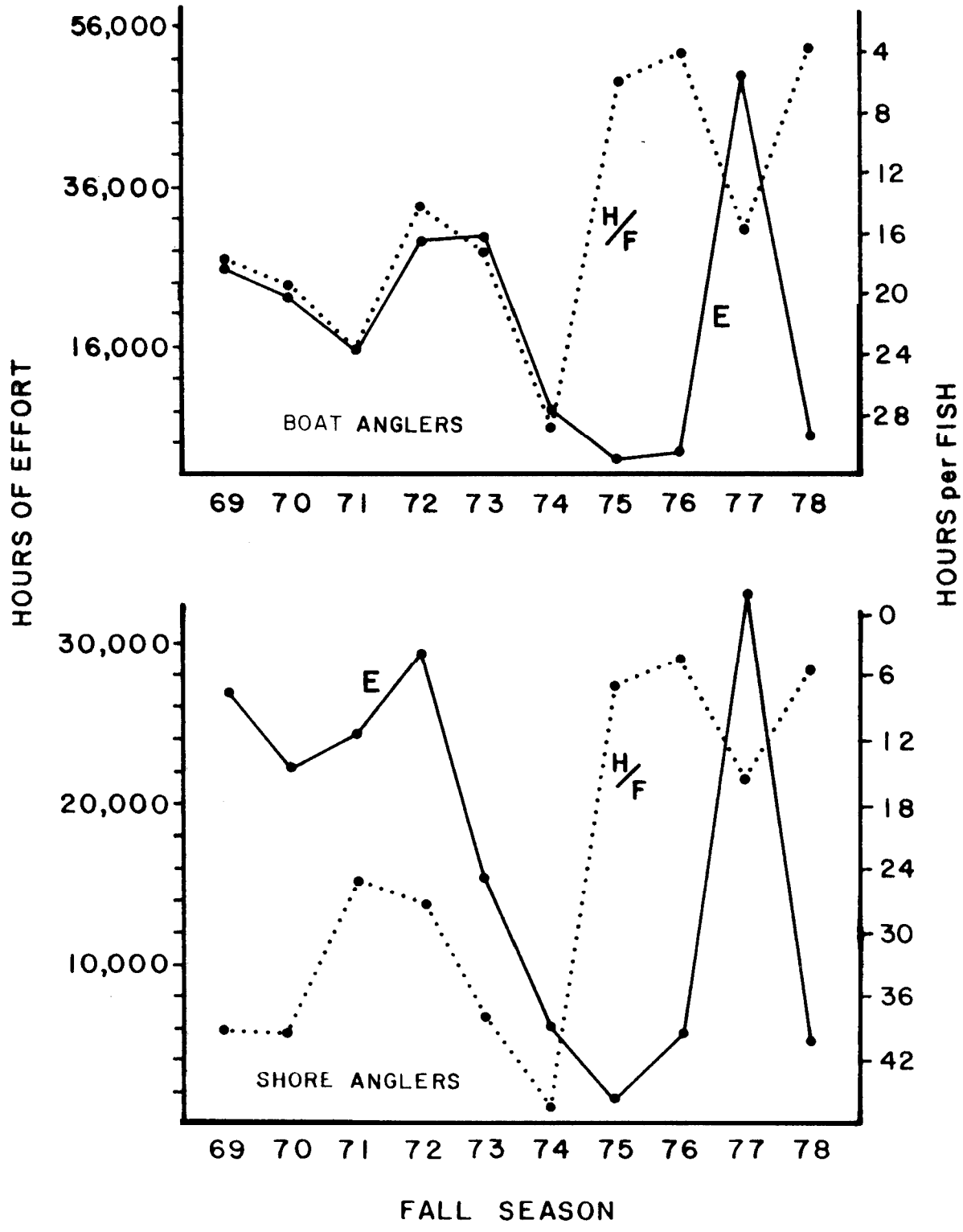

Figure 4. The estimated fall fishing effort (hrs) and corresponding catch rates (hrs/fish) during a ten-year period from 1969 to 1978. Estimates for boat and shore anglers fishing the lower Clearwater are treated separately.

during a fall season. Traditional steelhead fishing areas serviced by boat ramps like Cherrylane, Lenore and Myrtle, became so crowded that effective fishing was sometimes impossible, Workers counted more than 100 boats fishing between Lewiston and Orofino on several census trips during the first 30 days of the catch-and-keep season. We observed more than 20 boats in the pool below Cherrylane on three different occasions during the third census interval. As was the case with shore anglers, boat use dropped off significantly during the period between mid-November and mid-December due to poor river conditions.

We estimated that boat anglers fishing for steelhead accounted for approximately 60% of the fall effort (Table 2). This represented the second highest boat percentage during the 9-year investigation. Census estimates indicated that boat fishermen also caught approximately 60% of the catch during the fall season. During the 10-week catch-and-keep fishery, boat anglers released 3% (86) of their steelhead.

During the 1977 fall steelhead season project personnel made 3,761 angler interviews on the lower Clearwater River (Table 3). Approximately 87% of those sampled lived in Idaho, and 11% were non-residents. We made 64 interviews with Nez Perce tribal fishermen which accounted for only 2% of the sample. The percentage of non-resident anglers varied considerably during the season. We found that 28% of the fishermen came from other states during the 30-day catch-and-release fishery and 10% during the first 30 days of the consumptive fishery.

Non-resident steelhead anglers interviewed came mainly from the surrounding states. We found 71% of the non-residents resided in Washington, 16% in Montana, and 13% in other states (Table 3),

We found that anglers fishing with artificial lures accounted for 44% of those interviewed from shore. Flyfishermen provided for 10% of the shore interviews and bait fishermen 45%. During the 30 day catch-and-release fishery approximately 50% of the shore interviews were with flyfishermen, and 27% of the total angler interviews. Once the consumptive season began, flyfishermen composed >1% of the shore anglers interviewed. Boat angler interviews indicated that 71% fished with artificial lures and 29% with bait.

Angler interviews showed that the bulk of the steelhead harvest occurred in Area II, between Lenore and the old WWP Dam site (Table 3). We checked 53% of the fish sampled in Area II, which is also the longest census area on the lower Clearwater. Anglers fishing in Area I caught 20% of the 1977 harvest while those fishing in Areas III and IV took 22% and 5%, respectively.

During the 1977 fall steelhead season we separated Nez Perce tribal fishing statistics from the total census during the 30-day catch-and-release period. Between 15 September and 16 October, we estimated that tribal fishermen spent 900 hours to catch-and-keep 137 steelhead (Table 1). This is somewhat lower than the harvest made by Nez Perce fishermen during the first month of the 1976 season, but could be the result of the earlier opening date, since fewer fish would have entered the Clearwater. We found that Nez Perce anglers provided only 2% of the total interviews made in 1977. However, tribal fishermen accounted for 11% of those interviewed during the catch-and-release fishery. Less than 1% of the anglers interviewed during the consumptive steelhead season were Nez Perce.

Attempts to estimate the number of summer steelhead entering the Clearwater River during the fall fishing season (July-December) have become increasingly difficult. Different downstream survival rates between races of Snake River steelhead

Table 3. Summary of angler interviews during the1977 fall steelhead season on the lower Clearwater River.

	Number	Percent
Angler Interviews		
Residents	3,294	87
Nez Perce Indians	64	2
Non-residents	404	11
Washington	286	71
Montana	65	16
Other States	53	13
Angling Methods		
Shore Anglers	1,729	46
Lures	769	44
Flies	178	10
Bait	782	45
Boat Anglers	2,049	54
Lures	1,462	71
Bait	587	29
Steel head Caught		
Area I	158	20
Area II	415	53
Area III	177	22
Area IV	38	5

(especially hatchery stocks) and the benefits derived from juvenile transportation make predictions based on historical data questionable. Based on the 1977 Snake River dam counts (Lower Granite), hatchery returns and steelhead harvest rates, I estimated 22,100 fish entered the Clearwater during the fall (Table 4). Using this estimate, anglers caught approximately 23% of the run. But this catch percentage may be somewhat high, since anglers probably recaptured some fish released earlier during the non-consumptive portion of the season. If only the catch-and-keep harvest is used, anglers caught 17% of the estimated fall run. However, since most of the fish would have been kept had the consumptive season opened in September, the above harvest figures more accurately depict the 1977 fishery.

1978 Spring Steelhead Fishery

The Idaho Fish and Game Commission met in December and established the first spring steelhead season since 1974. The steelhead season on the lower Clearwater began 1 January and continued through 15 April. Spring season regulations allowed anglers to catch-and-keep six fish during the 4-month fishery.

An unusually wet winter and above normal temperatures caused the river to remain high and extremely turbid during most of the spring fishery. The high water levels and poor visibility made much of the lower Clearwater unfishable, and steelhead anglers began shifting their efforts to the North Fork below Dworshak Dam. Anglers also concentrated their efforts in the main Clearwater immediately below the North Fork confluence. In this area, from the confluence downstream to the McGill Hole (Nez Perce County line), river conditions were somewhat improved due to clear water withdrawals at Dworshak Dam.

The 1978 spring steelhead fishery on the lower Clearwater and North Fork below Dworshak Dam far surpassed any previous spring season in both angler participation and the number of fish harvested. Because of their migratory behavior (Ball and Pettit 1974), large numbers of hatchery steelhead continued to concentrate in the North Fork and larger pools immediately below the confluence **in** 1978 and the spring season developed into a crowded, almost carnival-like fishery. Hoping to improve their chances, steelhead fishermen tended to fish as close to the hatchery as possible. During late February and through March, workers commonly counted several hundred anglers fishing along the banks of the North Fork between the dam and hatchery. Because the Idaho Department of Fish and Game's closure sign sat approximately 9m (30 ft) above the actual confluence, anglers began fishing at the Dworshak Hatchery point. We often encountered groups of 50 to 100 anglers crowded onto the point, fishing elbow-to-elbow and standing one above another on the steep rip-rap shoreline (Fig. 5). Boat anglers encountered similar conditions, and popular runs and pools became difficult to fish because of the number of boats attempting to utilize the same areas. Workers often counted between 20 and 30 boats between the McGill Hole and the confluence.

We estimated that anglers fished a total of 110,200 hours during the 14-week spring steelhead season and caught 8,960 fish for an average catch rate of 12.3 hours per fish (Table 5). Steelhead anglers fishing from the bank spent an estimated 68,100 hours to catch 6,200 fish and averaged 11 hours per fish. During the same period, boat anglers fished 42,100 hours and caught 2,800 steelhead for an average success rate of 15.2 hours per fish. We also estimated that bank anglers caught-and-released 93 steelhead while their counterparts fishing from boats released 138 fish during the spring season.

During the 1978 spring season, shore anglers spent nearly five times more effort

Table 4. Number of adult steelhead counted (July-December) over Washington Water Power Dam; estimated effort, harvest, catch rate and percent of harvest during fall steelhead seasons, 1969-1978.

Year[a]	Clearwater steelhead run	Estimated effort (hours)	Hours per fish	Estimated harvest	Percent of dam count harvested
1969	9,522[b]	52,821	25	2,145	22.5
1970	8,876	44,288	26	1,713	19.3
1971	7,601	39,966	25	1,578	20.8
1972	12,044[c]	58,561	20	2,998	24.9
1973	9,846[d]	45,252	21	2,141	21.7
1974	2,475[e]	14,248	35	407	16.0
1975	4,400[f]	3,058	6.7	430	10.0
1976	5,500[g]	9,063	4.9	1,852	34.0
1977	22,100[h]	82,500	16	5,130	23.2
1978	10,530	10,935	4.4	2,465	23.0

[a]The 1969-1971 and 1977 fishing season opened on 15 September; the following seasons opened 1 October.
[b]WWP Dam counts.
[c]WWP Dam removed 6 Decmeber 1972.
[d]Based on estimated 38% of Little Goose Dam count.
[e]Based on estimated 30% of Little Goose Dam count; season closed 27 October.
[f]Based on estimated 40% of Lower Granite Dam count; season closed 30 November.
[g]Eased on return to DNFH; season closed 31 December.
[h]Based 66% of the Clearwater River escapement.

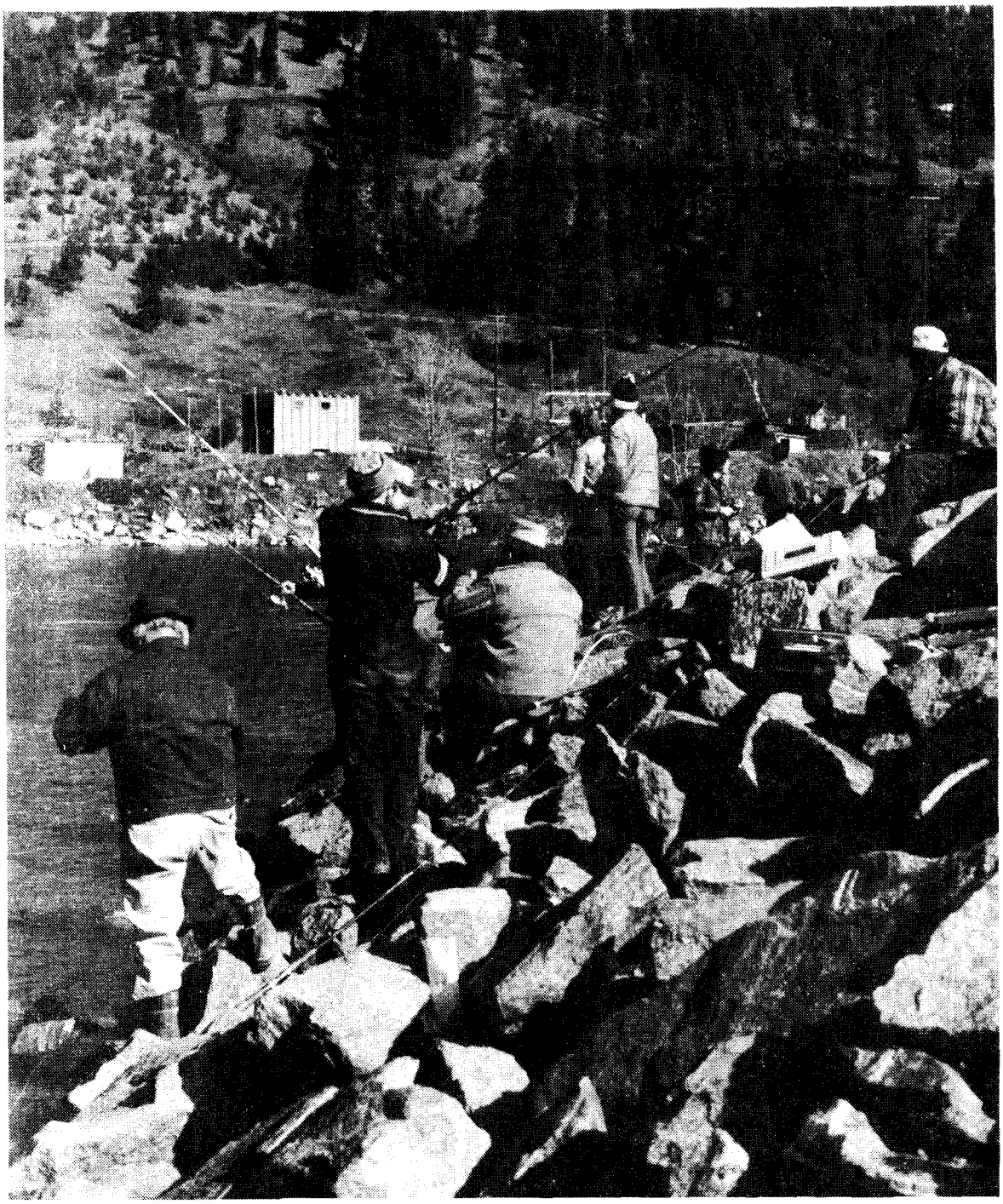

Figure 5. Steelhead anglers crowding the North Fork confluence located at Dworshak National Fish Hatchery during the 1978 spring season.

Table 5. Estimated effort, harvest and average catch rates per 2-week census intervals during the spring steelhead season on the lower Clearwater River, 1978.

Interval	Shore anglers			Boat anglers		
	Hours	Catch	H/F	Hours	Catch	H/F
1 Jan. to 14 Jan.	3,616	266	13.6	2,679	174 (12)*	14.4
15 Jan. to 28 Jan.	7,069	709	9.9	4,332	366 (16)	11.3
29 Jan. to 11 Feb.	8,960	588	15.2	5,910	502 (30)	11.1
12 Feb. to 25 Feb.	10,070	959 (57)*	9.9	10,516	809 (27)	11.1
26 Feb. to 12 Mar.	12,041	1,180	10.2	7,146	395 (17)	17.4
13 Mar. to 26 Mar.	16,828	1,717 (15)	9.8	6,746	281 (36)	9.7
27 Mar. to 16 Apr.	9,487	771 (21)	12.0	4,763	247	19.2
Totals	68,071	6,190 (93)*	10.8	42,092	2,774 (138)*	14.5

*Estimated steelhead released

than in 1973, the highest previous estimate (Table 6). Shore anglers also caught more fish than in any previous season on the lower Clearwater. The 6,200 steelhead that we estimated bank anglers harvested **in** 1978 so far surpassed any reported harvest in recent years (post impoundment), that our census techniques became suspect. However, Dworshak Hatchery personnel reported that on several occasions, anglers fishing from the point caught more than 100 steelhead in a single day during the spring season. We estimated that shore anglers spent 62% of the total effort to catch 69% of the spring steelhead harvested in 1978 (Table 7),

Although the lower Clearwater River below the North Fork provided excellent steelhead fishing during the few periods when water conditions improved, the bulk of the shore harvest occurred in the North Fork and immediately below the confluence. The spring fishery was characterized by groups of extremely crowded anglers all fishing in the same area. It is my opinion that anglers fishing for steelhead during the spring will tolerate crowded conditions more readily than anglers fishing during the fall season. However, the number of fishermen that often crowded the point of rocks at the mouth of the North Fork made it extremely difficult to avoid snagging other angler's gear and numerous altercations were observed between sportsmen at the hatchery point. Workers at Dworshak Hatchery experienced problems with anglers leaving their garbage and refuse from cleaning steelhead on the hatchery grounds. Fishing pressure became so intense at the point that anglers began remaining there overnight in sleeping bags in order to reserve the best locations the next morning. With utilization so heavy, the problems associated with human waste quickly developed, and hatchery personnel were forced to provide temporary lavatories at the point. Hatchery personnel also reported several cases of theft and vandalism during March, when anglers began remaining on the hatchery grounds overnight, Obviously, fisheries managers and Dworshak Hatchery personnel should work closely together to develop regulations to prevent similar occurrences in future catch-and-keep steelhead seasons.

Steelheaders fishing from boats spent an estimated 42,100 hours during the 1978 spring fishery, approximately 3 times more fishing effort than in 1973 (Table 6). Their estimated catch of 2,774 steelhead more than doubled the highest previous estimate and would have been substantially greater had boat anglers been able to take advantage of "open" areas at the confluence as shore anglers did. The success of boat anglers remained somewhat less than shore angler catch rates during the 1978 spring season, and the difference was the phenomenal success shore anglers had at the hatchery point. Several of the more popular steelhead pools below the mouth of the North Fork had intense fishing pressure by boat anglers in the spring and catch rates probably dropped as a result of the overcrowding.

Steelhead anglers generally have spent more time fishing from boats than from the bank during spring steelhead seasons. Prior to 1978, shore anglers expended more effort than boaters during only a single spring fishery (Pettit, 1976). This exception, favoring shore anglers, occurred during 1972 when Dworshak Reservoir filled and low flows restricted boat traffic (Table 6). We saw a reversal of this trend again in 1978. Our estimates showed shore fishermen spent 62% of the total effort and caught 69% of the steelhead harvested during the spring (Table 7).

Resident anglers accounted for 86% of the 3,500 angler interviews made during the spring steelhead season (Table 8), Non-resident fishermen accounted for 13% of our interviews and Nez Perce tribal members less than 1%. Most non-resident anglers lived in Montana (73%), and by the end of the spring season Montanans were accounting for approximately 25% of the total anglers interviewed. Anglers living in Washington accounted for 23% of the non-residents surveyed. We found that 98% of

Table 6. Angler effort, catch and catch rates during the spring steelhead season (January-April) on the lower Clearwater River, 1970-1974, and 1978

	Boat anglers			Shore anglers		
Year	Hours	Catch	H/[)	Hours	Catch	(H/F)
1970	8,171	282	28.98	6,324	47	134.5
1971	7,432	390	19.1	5,120	113	45.3
1972[a]	323	12	26.9	1,020	25	40.8
1973[b]	12,114	1,064	11.4	10,587	600	17.7
1974	8,490	723	11.7	5,706	252	22.6
1978	42,093	2,774	15.2	68,071	6,190	11.0

[a]Spring steelhead season closed 29 February 1972
[b]Season closed 15 March 1973

Table 7. Proportion of total effort and steelhead harvest estimates during spring steelhead seasons, 1970-1974, and 1978

	Percent of effort by		Percent of harvest by	
Year	Boat anglers	Shore anglers	Boat anglers	Shore anglers
1970	56	44	86	14
1971	59	41	78	22
1972	24	76	32	68
1973	53	47	64	36
1974	60	40	74	26
1978	38	62	31	69

Table 8. Summary of angler interviews during the 1978 spring steelhead season on the lower Clearwater River.

	Number	Percent
Angler interviews		
Residents	3,004	86
Nez Perce Indians	32	1
Non-residents	464	13
Montana	341	73
Washington	106	23
Other States	17	4
Angling methods		
Shore anglers	2,070	59
Bait	2,035	98
Lures	35	2
Boat anglers	1,448	41
Bait	1,119	77
Lures	329	23
Steelhead harvested		
Area I	8	71
Area II	189	22
Area III	259	30
Area IV	396	46

the bank anglers interviewed used bait, and 77% of the boat anglers. The remaining anglers chose to use artificial lures during the spring season. No flyfishermen were encountered during the census.

Wild Steelhead Escapement

During the 1977-1978 fish run, I estimated that approximately 6,800 wild summer steelhead entered the Clearwater drainage. I arrived at this figure by combining the estimates for both returns to Dworshak and Pahsimeroi Hatcheries (33,700 fish) and then subtracting the hatchery steelhead from the final dam count (56,300 fish) for the fish-year. The remaining 22,600 steelhead I assumed wild, and then relied on historical figures to determine the Clearwater River contribution to the wild escapement. Assuming that 30% of the wild steelhead escapement over Lower Granite originated from Clearwater stocks, then approximately 6,800 wild fish entered the Clearwater River.

Information gained from fall and spring census interviews indicated steelhead anglers captured an estimated 900 steelhead of wild origin, Workers determined 15% of the fish harvested during the fall steelhead season, and 3% of the spring harvest were of wild origin. Therefore, our estimate for wild fish escapement to the upper Clearwater and tributaries is 5,900. Although 1978 escapement remains far below estimates for wild fish numbers prior to 1973, it does continue the upward trend from the disastrous return in 1975 (Fig. 6).

Census workers measured a total of 102 wild steelhead from angler's creels during the 1977-1978 fishery. We found wild steelhead in the catch averaged 72.6 cm (28.6 in) in fork length. Unlike steelhead of the hatchery origin, we found wild fish length frequencies strongly tri-modal, and indicative of the different stocks and age-class representation of the various wild races in the Clearwater system (Fig. 7). The initial peak at the 62 cm (24.5 in) length most likely represents the smaller race of steelhead utilizing the lower Clearwater tributaries such as Lapwai, Bedrock and Big Canyon Creeks. The next two peaks may represent the 1 and 2-ocean age-classes of upper Clearwater River wild stocks, utilizing the major tributaries of the Lochsa and Selway drainages.

High stream flows and poor weather conditions prevented project workers from making any steelhead spawning surveys. However, U.S. Forest Service personnel at Powell Ranger District reported observing significantly more adult fish and redds in the upper Lochsa and tributaries during the spring of 1978 (Alan Christensen, personal communication). Forest Service workers made a moderately intensive ocular survey of Crooked Fork up to about 1.6 km (1 mi) above the U.S. 12 bridge, Papoose Creek, lower 1.6 km (1 mi), Squaw Creek up to the junction of west and east forks, and the main Lochsa down to Boulder Creek on 18 April 1978. They located 21 adult steelhead and 25 redds in various locations. It appeared that the presence of adults had peaked the previous week since they found six redds above the mouth of Badger Creek with only a single fish in attendance. Workers also reported that adult fish arrived somewhat earlier in 1978 than they had during the previous 3 years. In 1977, Forest Service workers only observed five adult steelhead in the same area.

Dworshak Hatchery Return

Workers at Dworshak Hatchery reported that 12,700 adult summer steelhead returned to the hatchery ladder and the trap at the base of the dam during the 1978

Figure 6. The estimated number of wild steelhead escaping to the upper Clearwater River and tributaries, 1969-1979.

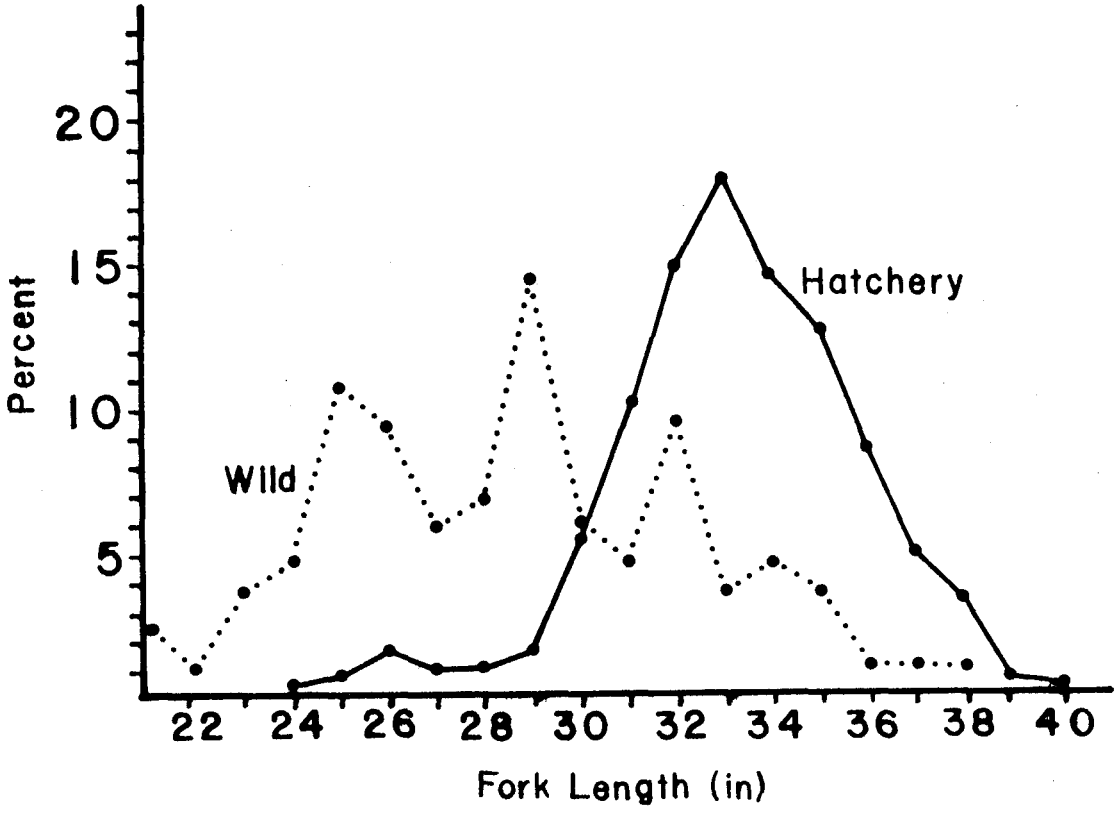

Figure 7. The length frequency distribution of adult, hatchery steelhead from both angler's creels and from the return at Dworshak National Fish Hatchery during the 1977-1978 fish year. Fish were measured to the nearest 1/2-inch.

spawning run, We estimated anglers harvested 12,004 hatchery steelhead in the lower Clearwater and North Fork during 19771978. rn addition to the Clearwater harvest, anglers fishing the Snake River between Asotin and the confluence caught overwintering Dworshak Hatchery steelhead prior to their return to the Clearwater. I estimated, based on punch card returns from both Idaho and Washington, that an additional 2,000 Dworshak fish were harvested in the Snake River. Therefore, a total of approximately 26,700 Dworshak steelhead returned to the Clearwater drainage. This escapement represents 47% of the steelhead that crossed Lower Granite Dam (56,970) during the 1977-1978 fish year.

The very successful return of hatchery steelhead **in** 1977-1978 more than doubled the best previous returns **in** 1973 and 1974 (Table 9). I estimated that Dworshak Hatchery fish provided approximately 80% of the Clearwater escapement, and also accounted for 93% of the steelhead harvested during 1977-1978. Dworshak Hatchery returns averaged 54% of the entire Clearwater escapement and ranged between 35% to 70% during the 5-year period beginning in 1973 (Table 9).

Project workers measured 1,155 summer steelhead from angler's creels during the, 1977-1978 fishery on the lower Clearwater which showed marks and deformed fins of hatchery origin. The sports catch was characterized by an almost complete absence of smaller 1-ocean hatchery steelhead and a larger-than-average size for 2-ocean fish. We found that the average fork length for hatchery fish in the sports catch measured 84.3 cm (33.2 in). Only 4.7% of the hatchery fish measured were under 73 cm (29 in), the fork length which usually denotes a 1-ocean return. We found length frequencies for hatchery steelhead measured from angler's creels strongly uni-modal (Fig. 7).

A total of 1,288 (10%) steelhead were sampled at Dworshak Hatchery during the 1978 spawning operations. Workers measured each fish to the nearest 25 mm (0.1 in) in fork length. The 1,288 fish measured consisted of 384 (30%) males and 904 (60%) females. The average length for returning adults in the 1978 spawning run was 84.3 cm (33.2 in), identical to the average length recorded from the sports harvest. The average length for females was 82.6 cm (32.5 **in)** and 86.9 cm (34.2 in) for males. Only in 1974 was the average length for returning adults larger, when males averaged 89.3 cm (35.2 in) and females 83.9 cm (32.9 in). The similarity to the 1974 return should be noted, especially since returning 2-ocean adults would be progeny of the 1974 brood. As expected, the length frequency distribution for 1978 hatchery adults was strongly uni-modal (Fig. 8).

We estimated the final return percentage for the 1974 release at .091, slightly higher than the previous release (Table 10). The 1977-1978 fish run completed the 1, 2 and 3-ocean return for adults from the 1974 outmigration. Many of the now completed nitrogen abatement structures at Snake and Columbia River projects had not been completed in 1974 and downstream mortality remained high. Mass juvenile transportation around the seven impoundments had not yet begun. Poor adult returns from 1974 releases at Dworshak Hatchery also occurred due to the poor health of smolts reared at the hatchery. Workers downstream from the hatchery reported that Dworshak smolts trapped at Little Goose Dam were **in** the poorest condition of any release yet observed. We estimated only 3,100 adults returned to the Clearwater River and the hatchery from a release of approximately 3,397,000 smolts.

Table 9. The estimated number of steelhead into the Clearwater River and the proportion of Dworshak Hatchery fish and native, wild steelhead entering the river for the fish runs between 1972-73 and 1978-79. The table includes harvest estimates for both hatchery and wild steelhead as well as escapements to Dworshak Hatchery and upper Clearwater tributaries.

Run component	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
Estimated run size	20,330	14,610	3,640	6,400	6,360	33,530	15,960
Hatchery return	11,890	10,230	1,850[a]	2,280[a]	3,510	26,730	9,550
Percentage	58.5	70.0	50.8	35.6	55.2	79.7	59.8
Harvest	2,068	2,320	290[b]	430[b]	410[b]	14,000[c]	4,610
To Dworshak	9,830	7,910	1,560	1,858	3,100	12,730	4,940
Wild fish return	8,440	4,300	1,000	2,200	2,850	6,800	6,410
Percentage	41.5	29.4	27.5	34.4	44.8	20.3	40.2
Harvest	3,325	650	100[b]	100[b]	50[b]	900	210
Escapement	5,115	3,650	900	2,100	2,800	5,900	6,200

[a]Does not include hatchery straying past North Fork
[b]Nez Perce Tribal harvest only (catch-and-release)
[c]Includes 2,000 steelhead caught in Snake River

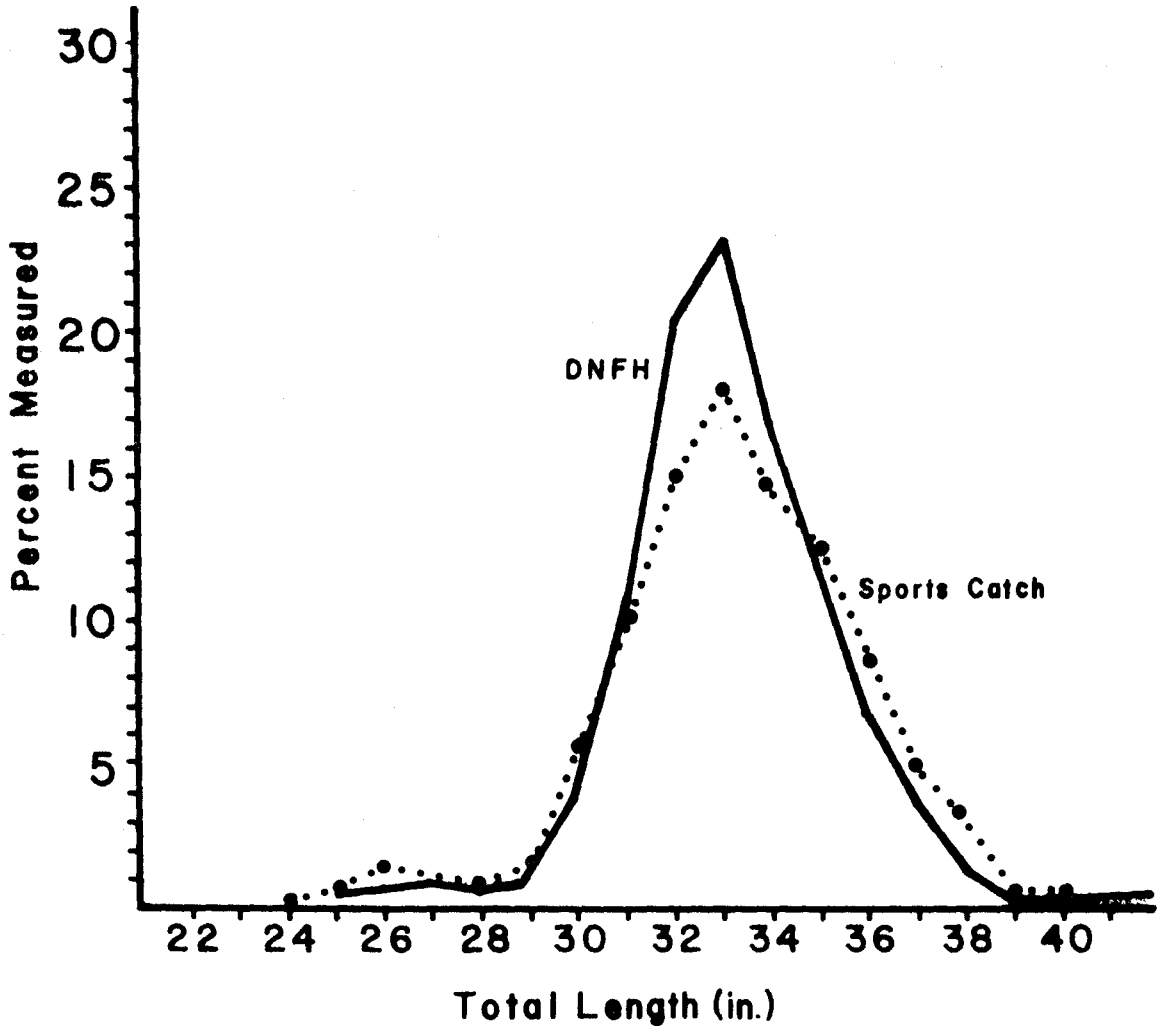

Figure 8. The length frequency of Dworshak hatchery steelhead during the 1977-1978 fish year. Distributions for fish measured in the sports catch are shown separately from those taken during spawning operations at the hatchery.

Table 10. Number and percent of adult steehead returns to the Clearwater River from Dworshak smolt releases. Returns include hatchery spawning run and harvest in lower Clearwater River.

Release year	No. smolts	One ocean	%	Two ocean	%	Three ocean	%	Total	%
1970	1,371,543	(1972) 834	.061	(1973) 9,916	.723	(1974) 906	.066	11,656	
1971	3,143,573	(1973) 1,421	.045	(1974) 8,767	.280	(1975) 34	.001	10,222	.325
1972	976,554	(1974) 1,872	.192	(1975) 1,393	.143	(1976) 55	.006	3,320	.340
1973	2,199,899	(1975) 414	.020	(1976) 1,450	.066	(1977) 52	.002	1,916	.087
1974	3,397,859	(1976) 345	.010	(1977) 2,345	.070	(1978) 394	.001	3,084	.091
1975	1,761,900	(1977) 1,115	.066	(1978) 25,413	1.440	(1979) 1,612	.092	28,180	1.600
1976	1,753,300	(1978) 905	.052	(1979) 7,919	.430				
1977	1,850,000	(1979) 507	.027						

Warm Temperature Hooking Mortality

During the spring and summer of 1977, I approached the Trout Unlimited organization to inquire whether steelhead catch-and-release research on the Clearwater would qualify for special TU funds designated for fisheries research. Although unable to provide research funds, TU directors made funding arrangements through the American League of Anglers for purchase of radio tracking equipment. A $1,000.00 donation from the ALA Education and Research Foundation provided the funds necessary to purchase 14 fish transmitter modules. I used the transmitters to monitor the behavior and determine the ultimate fate of summer steelhead caught-and-released during the late summer period while water temperatures remained above 15 C (59 F) in the lower Clearwater River.

Work by project personnel in 1976 indicated that a differential hooking mortality could possibly exist between steelhead released in the early fall, when river temperatures remained above 15 C (59 F) and fish released by anglers later in the fall and winter months (Pettit 1977). Workers marked released steelhead by placing a metal jaw-tag on the mandible. Radio telemetry equipment offered us an advantage over conventional marking methods, allowing workers continuous information on the movement and behavior of released fish. I felt this advantage was necessary in order to confirm their fate. Tag recovery programs previously used by Clearwater steelhead workers proved the majority of hatchery fish survived capture-and-release, but provided no information on those individuals which avoided recapture acid failed to return to the hatchery.

Project workers and cooperating sportsmen tagged and released more than 600 adult summer steelhead in the lower Clearwater River during the 1975-76 and 1976-77 fish runs, and only three jaw-tagged carcasses were ever recovered (Pettit, 1978). It seemed hooking mortality was very low, or steelhead carcasses remain submerged in deeper pools or hidden for reasons related to reduced rates of decomposition due to cold water temperatures. We hoped radio location procedures would enable us to determine whether or not a released fish had been killed, and possibly to locate and recover the carcass.

We began equipping captured steelhead with radio transmitters on 3 September and had placed all 14 transmitters in released fish by 24 September, 1977. We originally hoped to use only Dworshak Hatchery steelhead during the hooking mortality investigation so that transmitters might be recovered at the hatchery during spawning operations. It would also allow workers to identify and determine the occurrence of radio loss from regurgitation, since we also marked transmitter-equipped fish with external marks (jaw and anchor tags). However, we only captured five hatchery steelhead during the period when water temperatures remained above 15 C (59 F). The remaining 10 steelhead were determined to be of wild origin based on external marks and fin condition. We caught five individuals using flyfishing gear (3 hatchery and 2 wild steelhead). The remaining 10 fish (2 hatchery and 8 wild steelhead) were captured using hotshots trolled from a jetboat.

We found the apparent survival rate of radio-equipped, caught-and-released summer steelhead extremely high, although the migratory behavior of wild fish released during the study made it difficult to access long-term survival after release. Of the 14 steelhead originally caught by hook-and-line during September, only a single individual died as a result of hooking injuries. We caught, tagged and released this

steelhead (wild, 66 cm, female) on 13 September by hotshot and noted during the tagging process that gross injury had occurred in gill arches. We located the submerged carcass three days later, approximately 1 km (0.6 mi) below the release site in the tailout of the Hatwai Creek pool, river km 10.7 (mi 6.6). By using the radio location ability of a small, hand-held loop antenna, we "homed" in on the carcass and recovered it in approximately 2m (6.5 ft) of water. We recovered the transmitter and placed it in another fish on 23 September. We tracked the remaining 13 individuals, and the fish equipped with the recovered transmitter, for periods ranging between 4 and 177 days. Of the 8 surviving steelhead of wild origin, 6 migrated back downstream and left the Clearwater within 3 weeks after capture. We assumed these individuals left the lower Clearwater since project personnel could not locate the missing steelhead between the Middle Fork, km 119.5 (mi 74), and the Snake River confluence. On 30 October, I located two of the missing wild steelhead between 1 km (0.6 mi) and 8 km (5 mi) above Lower Granite Dam (Fig. 9). Other missing individuals may also have dropped downstream into Lower Granite Reservoir but avoided detection. Radio-tracking in the pool is extremely difficult due to river depths and signal interference from high voltage transmission lines.

We tracked the two remaining wild steelhead in the lower Clearwater for a period of 41 and 138 days respectively. The first individual remained in the release area (Spalding pool, km 19.2, mi 12) for approximately 20 days, then began moving upstream and remained in the Myrtle Beach area until late January, 1978. We then tracked it back downstream until losing the signal on 2 February at the Highway 95 bridge. The second fish was released on 13 September at the Cat Hole, km 9.8 (mi 6), and moved upstream until we lost it at Cottonwood Creek on 22 October. It is likely that this individual was caught and killed by a steelhead angler, since the consumptive steelhead season began on 17 October.

We monitored the movements of the five hatchery steelhead for periods ranging between 42 and 173 days after release. All radio-equipped hatchery fish moved upstream after release except for one individual which remained in the same pool until we lost the signal after 122 days. Two were recaptured and released a second time. Of the 4 transmitter-equipped hatchery fish which we tracked upstream after release, 2 returned directly to the North Fork where we believe anglers caught them before they could enter the hatchery. The third individual's transmitter failed shortly after original capture near the U.S. Highway 12 bridge, km 23.5 (mi 14.6), on 24 September. We did track its movement downstream to the Spalding pool, km 19.3 (mi 12), during the 2-day period while the transmitter continued working. We theorized the fish hadn't suddenly migrated out of the Clearwater when we lost radio contact, since the signal strength and pulse frequency of the transmitter became irregular immediately after release. We therefore suspected transmitter failure when we could no longer monitor that particular frequency. Project workers checked an angler who had caught and kept the steelhead just below the North Fork, km 62.8 (mi 39), on 5 November. The angler had kept the external dart tag, but had failed to locate the transmitter while cleaning the fish. The fourth hatchery fish which displayed upstream movement after release at Turkey Island, km 23.2 (mi 14.4) on 14 September was subsequently recaptured by project personnel on 23 September at the same location. Five days later the hatchery female began moving upstream and had reached the North Fork confluence by 6 December. However, we continued to track her upstream in the main Clearwater until she entered the Middle Fork on 21 January. The fish remained above Kooskia, km 119.7 (mi 74.4), until 30 January and then began moving slowly back downstream and entered the North Fork on 7 March.

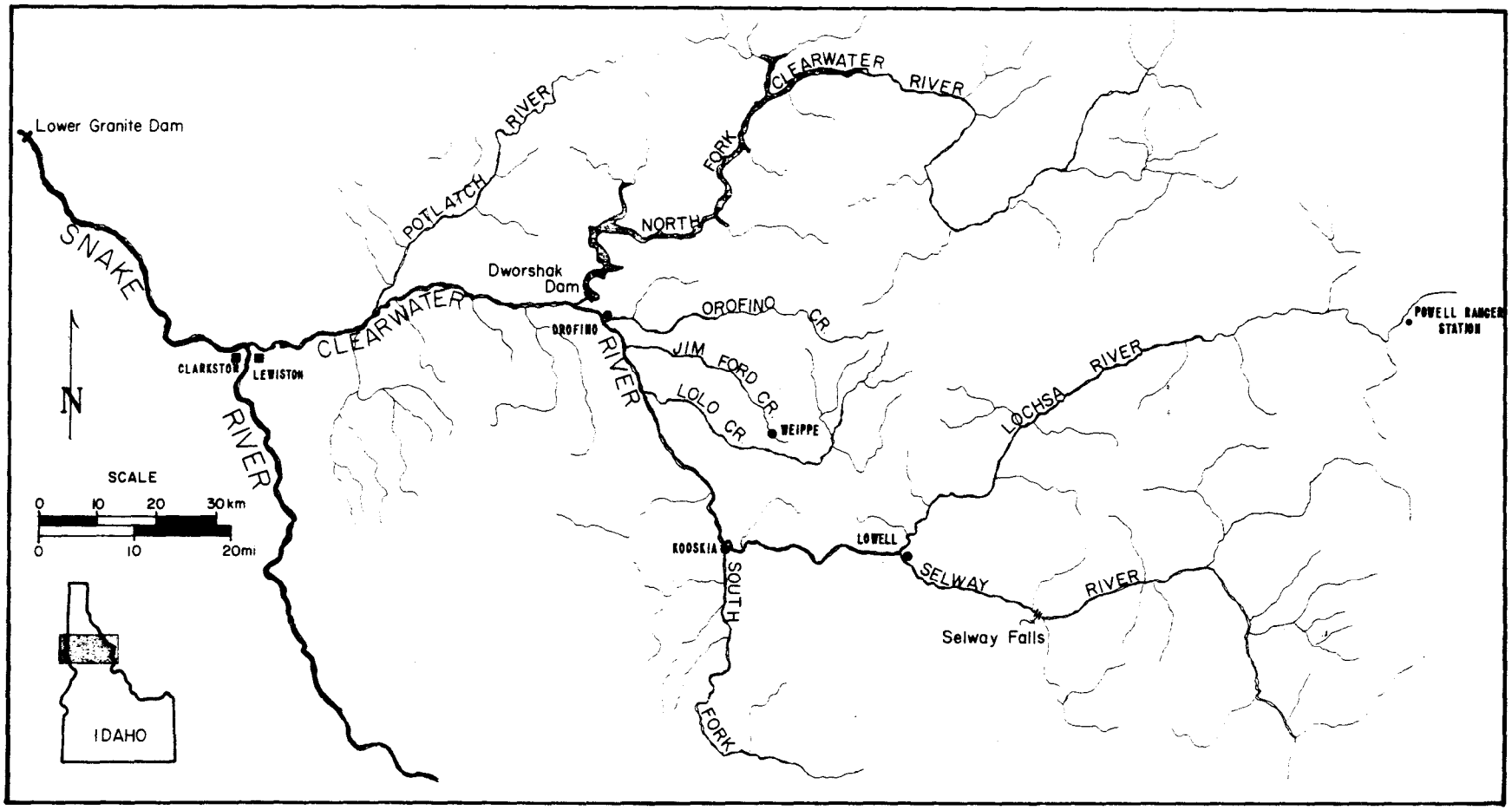

Figure 9. The Clearwater River drainage and Snake River from Lower Granite Dam upstream to Hell's Canyon.

I have attempted illustrating movement of caught-and-released steelhead from the lower Clearwater in Figure 10. The figure describes movement of transmitter equipped fish from the Snake River confluence upstream to the Middle Fork at river km 125.5 (mi 78). Distance downstream into Lower Granite Reservoir below the Clearwater confluence is also included in the figure. Movements during the 7-month tracking period appear as individual lines beginning at capture sites and dates. Vertical bars which terminate "tracking" lines indicate last radio contact. Circles indicate angler captures, and the crosses, recapture and release sites. The North Fork, at river km 64.4 (mi 40), is illustrated on the vertical axis. Because movement illustrated on a large scale failed to describe shorter movement and did not relate movement of study fish to river flows and temperature changes, I have included a short tracking history and log for each of the transmitter equipped steelhead.

Tracking Log

I caught, tagged and released the first radio-equipped summer steelhead on 3 September just below Rattlesnake Creek near Lenore, km 41.8 (mi 26) I used a flyrod and landed the fish in approximately 15 minutes. The female steelhead appeared to be of wild origin and measured 66 cm (26 in) in length. Water temperature and discharge were 18 C (64 F) and 3,900 cfs, respectively. The female remained in the same riffle where released until 20 September when I located her tracking upstream at 0900 hr. On the return trip downriver, I failed to locate her. Believing that she had moved upriver I continued to search between Lenore and Orofino for several days, but never located the fish again. The flows from Dworshak increased on 20 September and discharge went from 3,300 to 6,200 cfs which may have stimulated a rapid, downstream movement. I now believe that the fish was a wild steelhead from another Snake River tributary and had entered the Clearwater to avoid higher temperatures in the middle Snake.

Fish #1

Frequency	Location--river km	Date	Flows	Temp.	Remarks
6.24	Rattlesnake Cr. 41.8	9-3	3900	18.5	W F #6
6.25	" "	9-4	3470	18.0	down 100 m
6.25	" "	9-10	2740	17.0	
6.25	" "	9-14	2560	16.5	down 100 m
6.25	" "	9-15	2530	16,5	
6.24	" "	9-17	2670	16.5	
6.24	" "	9-18	3140	16.5	up 200 m
6.29	" "	9-20	6140	16.5	up 100 m
6.25	Couldn't locate	9-20			

I caught the next fish (#2) on 10 September at Turkey Island below the Arrow Bridge, km 23.2 (mi 14.4). I used a flyrod, and landed the 66.5-cm (26.2-in) hatchery male after a 15 minute fight. Water temperature and discharge were 17.8 C (64 F) and 2,740 cfs. The hatchery male remained in the same general area along Turkey Island until 25 September, when it was recaptured by a flyfishermen in the same riffle where I released it. After its release the second time, the fish dropped down into the tailout of the Turkey Island pool and remained there until we lost contact on 17 January 1978. I searched the lower Clearwater between the North Fork and Snake River unsuccessfully and suspect that the transmitter failed or that an angler caught it without recovering the tag.

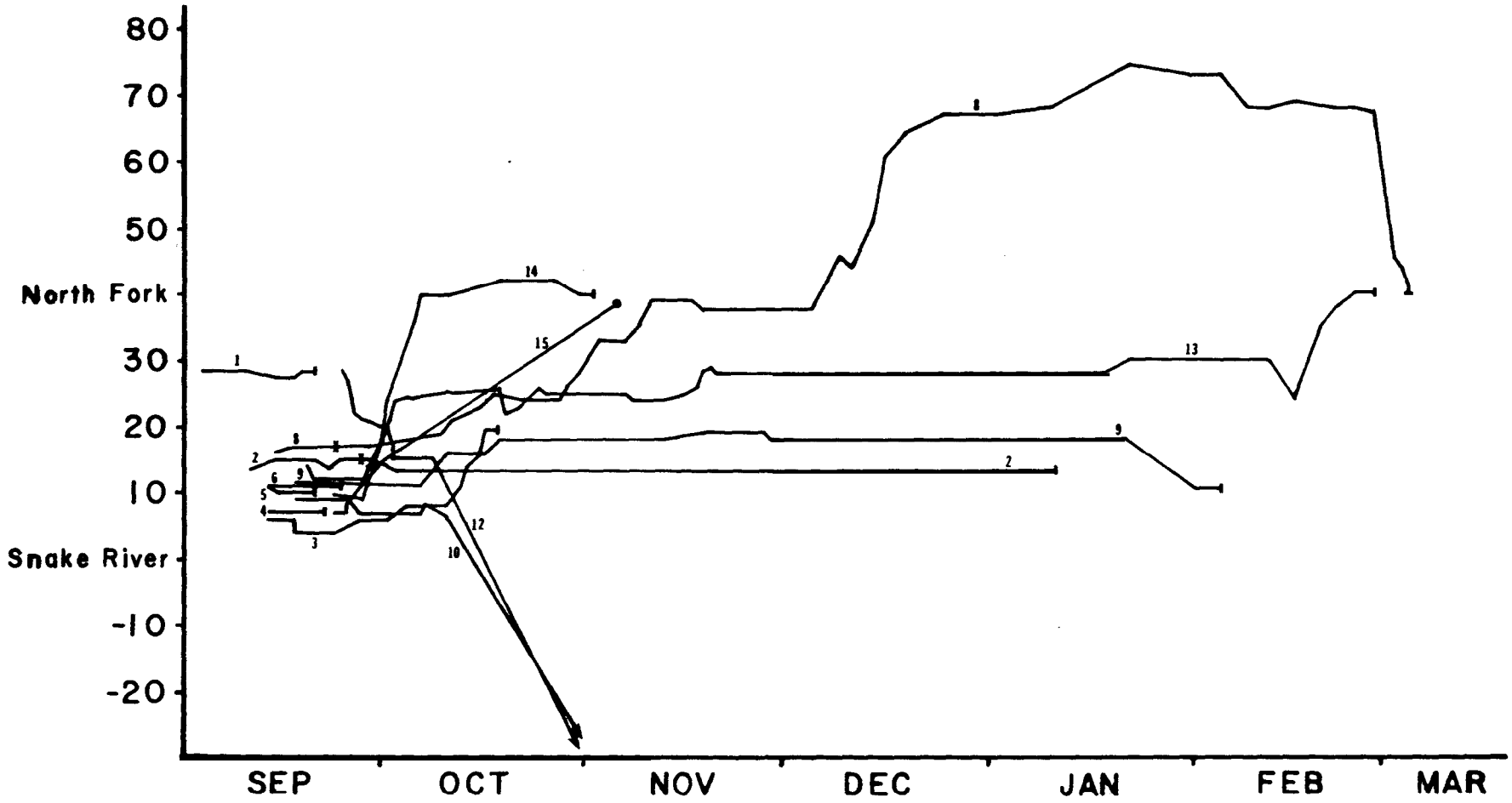

Figure 10. Movement of adult steelhead equipped with miniature radio transmitters prior to release by project anglers on the lower Clearwater River during the 1977-1978 fish year. Numerals associated with fish movements correspond to individual steelhead identified in the tracking log. Small x's refer to angler recaptures. Arrows represent two fish lost after release in Lower Granite Reservoir. The small bars indicate locations when radio contact was lost. Lines ending in circles represent fish caught and killed by anglers.

Fish #2

Frequency	Location--river km		Date	Flows	Temp	Remarks
6.35	Turkey Island	26.2	9-10	2740	17.8	HM #6
6.35	Turkey Tailout	26.0	9-19	3310	16.1	down 150 m
6.35	Lower Turkey	25.8	9-23	7070	13.4	down 100 m
6.35	Lower Turkey	25.8	9-25	3930	13.9	recaptured
6.35	Turkey Island	26.0	9-26	7120	14.5	up 150 m
6.35	Lower Turkey	25.6	10-1	10200	12.8	down 200 m
6.35	- Lower Turkey	25.6	10-27	7130	10.5	- - -
6.35	Turkey Island	26.2	11-1	5060	8.3	up 200 m
6.35	Lower Turkey	25.6	11-11	5400	6.1	down 200 m
6.35	Lower Turkey	25.6	12-5	22600	4.4	- - -
6.35	Middle Turkey	25.8	12-20	19000	4.4	up 200 m
6.35	Middle Turkey	25.8	1-6	15800	2.8	- - -
6.35	Middle Turkey	25.8	1-10	19700	3.3	- - -
6.35	Couldn't locate		1-17	19800	3.3	Lost-caught

The third steelhead (#3) was equipped with a transmitter on 13 September at the Cat Hole, km 9.8 (mi 6.1). We used a hotshot, trolled from the jetboat to capture a 68.6-cm (27-in) wild female. Water temperature and discharge were 17.2 C (63 F) and 2,610 cfs, respectively. As with all steelhead we captured from the jet-boat, we played them to exhaustion, netted them into the boat and placed the trans-mitter into the stomach without the use of MS-222. We released all boat caught fish along the shore, away from the main current. The wild female remained in the Cat Hole, km 9.8 (mi 6.1), for 4 days then moved downstream approximately 500 m (547 yd) where it remained until 28 September. She began moving upstream on 2 October and had reached Cottonwood Creek by 21 October, km 30.9 (mi 19.2). The fish was located approximately 300 m (328 yd) above Cottonwood Creek the following day, holding in a very popular riffle used by steelhead anglers. I was unable to locate her on 24 October, and unsuccessfully searched between Orofino and the confluence. I strongly suspect the fish fell victim to an angler who failed to find the tag or recover the transmitter. The fish also may have migrated downstream and entered the Snake River.

Fish #3

Frequency	Location--river km		Date	Flows	Temp.	Remarks
5.4	Cat Hole riffle	9.8	9-13	2610	17.3	WF #7
5.4	Cat Hole pool	9.7	9-15	2530	17.2	down 100 m
5.4	Cat Hole pool	9.7	9-17	2670	16.7	down 50 m
5.4	Old mill boom	9.3	9-17			down 500 m
5.4	Old mill boom	9.3	9-28	10800	13.4	- - -
5.4	Cat Hole tailout	9.6	10-2	8970	12.8	up 200 m
5.4	Upper Cat Hole	9.8	10-3	8210	12.8	up 300 m
5.4	Upper Cat Hole	9.8	10-6	5280	12.8	- - -
5.4	Lower Tiki	10.5	10-6			up 500 m
5.4	Lower Tiki	10.5	10-7	5190	13.9	- - -
5.4	KOA pool	11.9	10-9	5100	12.2	up 1.4 km
5.4	KOA riffle	12.2	10-15	4520	11.7	up 300 m
5.4	Spalding Mill	17.3	10-17	4330	11.1	up 5 km
5.4	Catholic Creek	22.2	10-18	4900	11.1	up 5 km
5.4	Gibbs Eddy	25.6	10-20	5200	11.7	up 3.4 km
5.4	Cottonwood Cr.	30.9	10-21	6880	11.7	up 5.3 km
5.4	Cottonwood riffle	31.6	10-22	4530	11.1	up 700 m
5.4	Couldn't locate		10-24	3740	10.5	caught?

We caught and tagged the fourth (#4) steelhead on 13 September in the Cat Hole km 9.8 (mi 6.1). We again used the trolling-hotshot method to land the small, 63.5-cm (25-in) wild female. River conditions were the same as above. This steelhead remained in the same location for 9 days until we lost radio contact. I tracked upstream to Greer, and downstream into the Snake River where I unsuccessfully searched as far upriver as the Grande Ronde confluence. I assume she dropped downstream and entered Lower Granite Reservoir, but I never relocated her during subsequent searches in the Granite pool.

Fish #4

Frequency	Location-river km		Date	Flows	Temp.	Remarks
11.4	Cat Hole pool	9.7	9-13	2610	17.3	WF #5
11.4	Cat Hole pool	9.7	9-14	2560	16.7	same
11.4	Cat Hole pool	9.7	9-15	2530	17.2	same
11.4	Cat Hole riffle	9.8	9-17	2670	16.7	up 200 m
11.4	Cat Hole riffle	9.8	9-19	3310	16.1	- - -
11.4	Cat Hole pool	9.7	9-21	8830	16.1	down 200 m
11.14	Couldn't locate		9-22	9730	13.9	lost

The fifth steelhead was also caught on 13 September just below the new Spalding Bridge, km 16.9 (mi 10,5), using the trolling-hotshot method. River conditions were the same as above, After release, we tracked the 76.2-cm (30-in) wild female for 8 days before we lost contact. She remained in the Spalding Bridge pool until contact was lost on 21 September. This was one of several steelhead lost shortly after increased flows from Dworshak discharge occurred on 20 September. I

assume she moved downstream into the Snake River since I unsuccessfully searched between Kooskia and the confluence.

Fish #5

Frequency	Location--river km		Date	Flows	Temp.	Remarks
5.28	Hwy. 95 bridge	16.9	9-13	2610	17.3	WF #11
5.28	Hwy. 95 bridge	16.6	9-15	2530	17.2	down 300 m
5.28	Hwy. 95 bridge	16.6	9-20	6140	16.7	- - -
5.28	Couldn't locate		9-2	8830	16.5	lost?

The sixth fish (#6) behaved identically to the wild female above. We caught the 78.7-cm (31-in) wild female in the Spalding bridge pool, km 16.9 (mi 10.5), on the same day, 13 September. River conditions remained the same as above. She stayed in the bridge pool for 5 days after release, then dropped down approximately 500 m (547 yd) on 21 September when the flows increased. She continued downstream another 500 m and we lost contact with her on 24 September near Hog Island, km 15.2 (mi 9.4). I assumed this individual moved out of the Clearwater overnight, and entered the Snake River.

Fish #6

Frequency	Location--river km		Date	Flows	Temp.	Remarks
2.15	Spalding bridge pool	16.9	9-13	2610	17.2	WF #12
2.15	Spalding bridge pool	16.9	9-18	3140	16.1	- - -
2.15	Lower bridge pool	16.4	9-21	8830	16.7	down 500 m
2.15	Upper Hog Island	15.1	9-22	9730	13.9	down 500 m
2.15	Upper Hog Island	15.1	9-23	7070	13.4	- - -
2.15	Middle Hog Island	14.9	9-24	6420	14,5	down 200 m
2.15	Couldn't locate		9-25	3930	13.9	lost?

The seventh (#7) steelhead provided the only documented hooking mortality. As previously mentioned, we captured it on 13 September near the KOA riffle, km 11.9 (mi 7.4). The 66-cm (26-in) wild female showed gross injury and a continual loss of blood from the gill arches when we released her. Death may have occurred immediately after release since the transmitter signals indicated a slow, steady downstream movement after release. We recovered the carcass approximately 1.4 km (0.9 mi) below the release site near the Hatwai Creek pool, km 10.5 (mi 6.5). Radiolocation was facilitated by using a hand held, loop antenna. The carcass was found slowly moving along the bottom of the Hatwai pool tailout, 4 days after release.

Fish #7

Frequency	Location--river km		Date	Flows	Temp,	Remarks
4.40	KOA riffle	11.9	9-13	2610	17.2	WF #6
4.40	Tiki Run	11.3	9-14	2560	16.7	down 600
4.40	Lower Tiki Ru	10.5	9-14			down 800
4.40	Lower Tiki Run	10.5	9-15	2520	16.7	- - -
4.40	Lower Tiki Ru n	10.5	9-16	2520	16.7	mortality

I caught and released the eighth (#8) radio-equipped fish using fly fishing gear on 14 September at Turkey Island km 23.2 (mi 14.4). The 78.7-cm (31-in) hatchery female fought for 25 minutes. River temperatures and discharge were 16.5 C (61.7 F) and 2,560 cfs, respectively. She remained in the Turkey Island pool, km 23.1 (mi 14.4), and was recaptured by project personnel trolling hotshots on 23 September. We located the fish's position with the hand held antenna in an attempt to find a concentration of steelhead and began fishing above its holding area. The fish was hooked almost immediately, and fought very determinedly for the second time. We did not realize that the fish we were about to tag carried a transmitter until the orange dart tag was discovered as it lay on the boat bottom. We added an opercal punch, for identification purposes, and quickly released it. After its second release it dropped downstream 200 m (219 yd) and then began moving upstream 4 days later. We followed her movement upriver for the next 50 days until she reached the North Fork confluence, km 64.4 (mi 40) on 10 November. Two days later, we tracked her back down-stream into the McGill hole, km 60.7 (mi 37.7), where the fish remained until the late November-early December floods. We began tracking her upstream 6 December, and continued until she stopped near the island above Lawyers Creek, km 116.6 (mi 72.5), on 10 January. She moved upstream again as far as river km 126.4 (mi 78.5) on 21 January and then began slowly dropping back downriver. We located her at the mouth of Lawyers Creek on 21 February and then monitored a fairly rapid return to the North Fork by 7 March. Contact was lost on 11 March along side Dworshak Hatchery in the main river and I assumed the fish was caught in the intense fishery occurring at the confluence point.

Frequency	Location--river	km	Date	Flows	Temp	Remarks
10.36	Turkey Island	23.2	9-14	2560	16.7	H F #11
10.36	Arrow tailout	23.4	9-17	2670	16.7	up 200m
10.38	Arrow tailout	23.4	9-23	7070	13.4	recaptured
10.38	Middle Turkey	23.1	9-25	3930	13.9	down 300m
10.37	Middle Turkey	23.1	9-26	7120	14.5	- - -
10.37	Arrow tailout	23.4	9-27	8200	13.9	up 300m
10.35	Arrow bridge pool	23.7	9-28	10800	13.4	up 300m
10.35	Gibb's eddy	25.4	10-1	10200	12.8	up 1.7 km
10.44	Gibb's eddy	25.7	10-3	8210	12.8	up 300m
10.44	Vest Pocket	28.7	10-5	5310	12.8	up 3 km
10.44	Myrtle pool	30.1	10-6	5320	12.8	up 1.4 km
10.44	Myrtle Beach	30.4	10-8	5200	12.8	up 300m
10.44	Cottonwood Creek	30.9	10-9	5200	12.2	up 500m
10.44	Cherrylane pool	33.8	10-10	5150	11.1	up 2.9 km
10.44	Cherrylane bridge	35.7	10-10	----	----	up 1.9 km
10.44	Pine Creek	37.9	10-15	4520	11.7	up 2.2 km
10.44	Windmill pool	40.0	10-18	4900	11.1	up 2.1 km
10.44	Windmill tailout	39.7	10-22	4530	11.1	down 300m
10.44	Upper Pine Creek	38.6	10-27	7130	10.5	down 1.1 km
10.44	Squaw Rapids	41.6	10-27	----	----	high-muddy
10.44	Lenore Bridge	46.7	10-30	5640	8.9	up 5.1 km
10.44	Kamp Tomahawk	53.1	11-2	5340	7.8	up 6.4 km
10.44	Kamp Tomahawk	53.5	11-6	5870	7.2	up 400m
10.44	Big Canyon Creek	56.8	11-8	5900	6.1	up 3.3 km
10.44	North Fork point	64.2	11-10	5380	6.6	up 7.4 km
10.44	North Fork point	64.2	11-12	5120	6.6	- - -
10.44	Black Rock	63.2	11-16	5960	6.0	down 1 km
10.44	McGill riffle	62.3	11-18	14000	5.5	down 900m
10.44	McGill pool	61.1	11-19	13700	5.5	down 1.2 km
10.44	Lower McGill	60.2	11-26	16500	4.4	down 900m
10.40	Middle McGill	61.0	12-4	28700	4.4	up 800m
10.40	Dowrshak Hatchery	64.6	12-6	13700*	1.7*	up 3.6 km
10.40	Orofino Airport	70.1	12-7	13300	1.1	up 6.0 km
10.40	Orofino Gun Club	73.7	12-8	11300	2.2	up 3.6 km
10.40	Orofino Gun Club	73.5	12-10	9350	.8	down 200m
10.40	Mile Post 50.8	81.7	12-13	10600	1.1	up 8.2 km
10.40	Six Mile Creek	94.9	12-14	19900	1.1	up 13.2 km
10.40	Mile Post 60.4	97.2	12-15	21700	1.7	up 2.3 km
10.40	Mile Post 64.2	103.3	12-18	14700	3.0	up 6.1 km
10.40	Kamiah bridge	108.0	12-24	8040	.8	up 4.7 km
10.39	Kamiah bridge	108.2	1-2	3200	.8	up 200m
10.40	Kamiah Islands	111.1	1-10	6910	.8	up 2.9 km
10.40	Mile Post 74.8	120.4	1--21	7340	.8	up 9.3 km
10.40	South Fork Conf.	118.1	1-30	5360	1.1	down 2.3 km
10.40	South Fork Conf.	118.2	2-4	5940	1.1	very muddy
10.40	Kamiah Airport	109.4	2-8	9010	2.2	down 8.8
10.40	Kamiah Airport	109.2	2-11	6600	2.2	down 200w
10.40	Heart of Monster	109.0	2-15	6580	2.2	down 200m
10.40	Lawyers Creek	108.2	2-21	7340	2.8	down 200m
10.40	Lawyers Creek	108.2	2-24	6070	2.8	- - -
10.40	Mile Post 63.5	102.2	2-27	5880	3.0	down 2 km

Fish #8 (Continued)

Frequency	Location--river	km	Date	Flows	Temp,	Remarks
10.40	Orofino Gun Club	73.7	3-2	7500	3.0	down 28.5
10.40	Orofino Airport	70.1	3-5	7140	3.3	down 3.6 km
10.40	Slaughter House	65.3	3-7	7300	3.3	down 4.8 km
10.40	Couldn't locate			11000	3.3	caught?

* Orofino guage after 6 Dec.

We caught and released the ninth (#9) steelhead on 17 September near Spalding Park, km 19.2 (mi 11.9) using the hotshot-trolling method. River temperature was 16.7 C (62.1 F) and flows at Spalding, 2,670 cfs. The fish was a wild female approximately 68.6 cm (27 in) in length. She remained in the Spalding pool for the next 19 days. We tracked upstream movement beginning on 9 October and followed her progress upriver as far as Cottonwood Creek, km 30.7 (mi 19.1). On 28 November the wild female began dropping downstream and spent the month of December in the Myrtle Beach pool, km 28.8 (mi 17.9). She remained in the Myrtle Beach area until we lost contact on 22 January. We relocated her on 31 January just below the new Spalding bridge where she remained until we lost contact for the last time on 3 February. I could not locate the signal while searching between the North Fork and confluence. Fishing pressure was moderately heavy below the Spalding bridge during the same period and she may have been captured or moved downstream rapidly and entered the Snake River.

Fish #9

Frequency	Location--river	km	Date	Flows	Temp.	Remarks
1.12	Spalding Park	19.2	9-17	2670	16.7	WF #7
1.10	Lapwai Creek	19.0	9-17	----	----	down 200 m
1.10	Spalding Park	19.3	9-18	3140	16.1	up 200 m
1.20	Spalding Park	19.3	10-6	5280	12.8	- - -
1.20	Catholic Creek	22.1	10-9	5100	12.2	up 2.8 km
1.20	Turkey Island	23.2	10-10	5160	11.1	up 1.1 km
1.19	Turkey Island	23.2	10-15	4520	11.7	- - -
1.18	Arrow bridge	23.6	10-17	4330	11.1	up 400 m
1.17	Gibb's Eddy	25.7	10-18	4900	11.1	up 2.1 km
1.16	Gibb's Eddy	25.5	11-3	5400	6.1	down 200 m
1.18	Gibb's Eddy	25.8	11-12	5120	6.1	up 300 m
1.18	Myrtle Islands	27.4	11-15	5470	5.0	up 1.6 km
1.13	Myrtle Rapids	28.4	11-18	14000	4.4	up 1.0 km
1.13	Cottonwood Creek	30.7	11-19	13700	4.4	up 2.3 km
1.13	Cottonwood Creek	30.7	11-27	13700	3.3	- - -
1.13	Myrtle Beach	28.8	11-28	16100	2.8	down 1.9 km
1.13	Myrtle Beach	28.6	11-29	16700	2.8	down 200 m
1.13	Myrtle Beach	28.8	1-16	18600	3.3	up 200 m
1.13	Myrtle bridge	28.9	1-21	20100	3.3	up 100 m
1.13	Couldn't locate	----	1-22	20500	2.8	lost
1.13	Spalding bridge	16.5	1-31	16500	3.3	down 12.4 km
1.13	Spalding bridge	16.4	2-2	16500	3.9	down 100 m
1.13	Couldn't locate	----	2-3	17500	3.9	caught-lost?

We caught and released the tenth (#10) radio equipped steel head on 17 September near the middle channel of Hog Island, km 15.2 (mi 9.5), by trolling a hotshot. River temperature and discharge were the same as above. We released the wild, 68.6-cm (27-in) male in the deep run between the islands, km 15.1 (mi 9.4), and lost contact with him in the same location 23 days later. We verified that the fish was alive several times during the 3-week period, but failed to relocate the steelhead while searching between the North Fork and confluence once we lost contact. On 30 October, I located the fish approximately 8 km (5 mi) above Lower Granite Dam while searching the Snake River reservoir. I can only surmise that the individual had become disorientated, or that it may have been a Tuccannon River or lower Snake River tributary fish which had temporarily strayed across Lower Granite.

Fish #10

Frequency	Location--river	km	Date	Flows	Temp.	Remarks
8.45	Hog Island pool	15.2	9-17	2670	16,7	WM #7
8.45	Hog Island pool	15.2	9-25	3930	13.9	no movement
8.45	Hog Island riffle	15.4	9-26	7120	14.5	up 200 m
8.38	Middle island	15.1	9-27	8100	13.9	down 300 m
8.40	Middle island	15.1	10-1	10200	12.8	- - -
8.40	Hog Island riffle	15.3	10-6	5280	12.8	up 200 m
8.50	Middle island	15.1	10-6	----	----	down 200 m
8.50	Lower island	14.9	10-9	5100	12.2	down 200 m
8.50	Couldn't locate		10-10	5160	11.1	lost
8.50	Lower Granite pool	NA	10-30	NA	NA	8 km above dam

We tagged and released the eleventh fish (#11) in the slack water arm of Lower Granite pool near the PFI intake, km 5.9 (mi 3.7), on 17 September. Water temperature was 17.8 C (64 F). We captured the 66-cm (26-in) wild female by trolling hotshots. We had difficulty receiving transmitter signals due to high tension, transmission lines in the vicinity, and lost contact altogether 3 days after release when flows increased. We searched unsuccessfully upstream and downstream into the Snake River from the jet boat. Since the steelhead was captured in a documented, high density "holding" area, I suspect she was most likely a Salmon River, or upper Snake tributary fish temporarily holding in the cooler, Clearwater arm of the reservoir.

Fish #11

Frequency	Location--river	km	Date	Flows	Temp.	Remarks
2.38	PFI Mill Run	5.9	9-17	2670	17.8	WF #6
2.38	PFI Mill Run	5.8	9-18	3140	17,0	weak
2.38	PFI Mill Run	5.8	9-19	3310	17.0	weak
2.38	Lost contact	5.8	9-20	6140	16.7	flows up

I caught-and-released the twelfth (#12) radio-equipped steelhead with fly-fishing gear on 19 September near Rattlesnake Creek, km 45.4 (mi 28.2). The 63.5-cm (25-in) wild female fought for 10 minutes prior to tagging. Water temperature

and discharge were 16.1 C (61 F) and 3,310 cfs, respectively. This wild female was the smallest fish we equipped with a transmitter and I experienced some difficulty introducing the module past the esophageal sphincter. She began dropping downstream immediately after release, and continued downriver until holding in the riffle at Myrtle Island on 27 September. I documented slight upstream movement during the 10 days she remained in the riffles along the south side of the island. Prior to monitoring upstream movement, I suspected that she had died and that the carcass was being displaced downstream by the current. On 6 October I lost contact and searched unsuccessfully between the confluence and Kamiah, km 107.5 (mi 66.8). I relocated her transmitter signal in Lower Granite Reservoir on 30 October. I received a weak signal from approximately 900 m (984 yd) above the dam and experienced difficulty in verifying the signal due to high-tension transmission line interference.

Fish #12

Frequency	Location--river km		Date	Flows	Temp.	Remarks
7.25	Rattlesnake Creek	45.4	9-19	3310	16.1	small WF #25
7.26	Agatha Hole	43.4	9-20	6140	16.7	down 2 km
7.26	Cherrylane bridgepool	34.2	9-21	8830	16.7	down 9.2 km
7.25	Cherrylanebridgepool	34.0	9-22	9730	13.9	down 200 m
7.25	Cherrylane bridge	33.7	9-23	7070	13.4	down 300 m
7.23	Cherrylane tailout	33.3	9-25	3930	13.9	down 4U0 m
7.21	Cherrylane pool	33.6	9-26	7120	14.5	up 300 m
7.25	Myrtle Beach	28.8	9-27	8200	13.9	down 4.8 km
7.25	Myrtle Island	27.4	9-27	----	----	down 1.4 km
7.24	Myrtle Island	27.1	10-1	10200	12.8	down 300 m
7.24	Myrtle Island	27.2	10-2	8970	12.2	up 100 m
7.31	Myrtle Island	27.2	10-3	8210	12.8	- - -
7.31	Lost contact	27.2	10-6	5280	12.9	lost
7.31	Lower Granite Pool	NA	10-30	NA	NA	dam + 900 m

I caught-and-released the thirteenth (#13) radio-equipped steelhead with fly fishing gear on 23 September near Hog Island, km 15.3 (mi 9.5). The 78.7-cm (31-in) hatchery female fought for 20 minutes. Water temperatures and discharge were 13.9 C (57 F) and 7,070cfs,respectively.She dropped downstream 300 m (328 yd) after release and continued down river until holding at Coyote Fishnet, km 13.9 (mi 8.6), for 2 days. We began tracking the hatchery female upstream on 26 September until we lost contact at Squaw Rapids, km 41.6 (mi 25.8), on 17 October. I searched upstream as far as the North Fork without success, only to relocate her signal downstream 6.4 km (4 mi) at Fir Bluff, km 36.0 (mi 22.4), on 19 October. She began moving upstream again on 22 October and held in the Squaw Rapids below Bedrock Creek again. We then tracked her downstream 300 m (328 yd) into the Windmill pool, km 40.0 (mi 24.9), where she remained for the next 20 days. During this period, she slowly dropped back down to the tailout of the Windmill pool and then began retracing her movement back upstream to the head of the pool at Squaw Rapids. We located her in the Big Eddy pool, km 43.9 (mi 27.3) on 20 November where she remained for the next month. She repositioned several times during this period, and took refuge in the large back-eddy during the late November-early December flood. She began moving again on 21 January during a period of high, turbid flows after a sudden mid-winter thaw. She moved progressively upriver until reaching mile post 30, km 48.3 (mi 30),

and remained in a deep pool for the next 21 days, On 15 February we located her back downstream above Pine Creek, km 38.6 (mi 24) and then found her moving through the Peck-Big Canyon pool, km 54.7 (mi 34), 4 days later. I cannot explain this rapid downstream movement and equally rapid return upstream. High and muddy flows may have caused disorientation or she may have been hooked by an angler and dropped downstream after escaping. She continued upstream from Peck and we lost contact for a final time on 21 February in the McGill hole, km 61.1 (mi 38). I suspect a steelhead angler captured the fish since we thoroughly searched the North Fork below the dam without success. We tracked the hatchery female for 157 days.

Fish #13

Frequency	Location--river	km	Date	Flows	Temp	Remarks
4.42	Hog Island	15.3	9-23	7070	13.9	HF #12
4.42	Middle Island	15.0	9-24	6420	14.5	down 300 m
4.40	Coyote Fishnet	13.9	9-25	3930	13.9	down 1.1 km
4.41	Coyote Fishnet	13.9	9-26	7120	14.5	0800 hrs
4.40	Spalding mill	18.0	9-26	----	----	1800 hrs
4.40	Turkey Island	23.2	9-27	8600	13.9	up 5.2 km
4.38	Gibb's Eddy	25.8	9-28	10800	13.4	up 2.6 km
4.38	Myrtle bluffs	26.1	9-29	10900	13.4	up 2.6 km
4.38	Cherrylane bridge	33.9	10-1	10200	12.8	up 7.8 km
4.50	Windmill tailout	39.4	10-3	8210	12.8	up 5.5 km
4.50	Mile post 25	40.2	10-5	5310	12.8	up 800 m
4.50	Squaw Rapids	40.5	10-9	5100	12.2	up 300 m
4.50	Agatha School	40.1	10-10	5160	11.1	down 400 m
4.50	Squaw Rapids	40.5	10-17	4330	11.1	up 400 m
4.50	Fir Bluff pool	36.0	10-19	5280	11.7	down 4.5 km
4.50	Pine Creek	37.8	10-22	4530	11.1	up 1.8 km
4.50	Squaw Rapids	40.5	10-24	3740	10.5	up 2.7 km
4.50	Mile post 25	40.2	10-27	7130	10.5	down 300 m
4.50	Agatha School	40.0	11-3	6280	7.2	down 200 m
4.50	Windmill tailout	39.5	11-8	5900	6.1	down 500 m
4.50	Windmill pool	39.9	11-12	5120	6.1	up 400 m
4.50	Squaw Rapids	40.5	11-18	14000	4.4	up 600 m
4.50	Rattlesnake Creek	45.6	11-19	13700	4.4	up 5.1 km
4.43	Big Eddy pool	45.9	11-20	12800	4.4	up 300 m
4.43	Big Eddy pool	46.3	12-10	15200	4.4	up 400 m
4.43	Big Eddy pool	45.8	1-6	15800	3 9	down 500 m
4.43	Big Eddy pool	46.3	1-17	19800	4.4	up 500 m
4.43	Mile post 30 pool	48.3	1-21	20500	3.9	up 2 km
4.43	Mile post 30 pool	48.0	1-30	16900	4.4	down 300 m
4.43	Mile post 30 pool	49.7	2-11	20300	5.0	up 1.7 km
4.43	Mile post 24	38.6	2-15	17600	4.4	down 11.1 km
4.43	Peck-Big Canyon	54.7	2-19	16400	5.0	up 16.1 km
4.42	McGill tailout	60.1	2-21	18000	5 5	up 5.4 km
4.42	Lost contact		2-24	17500	5.0	caught?

I caught and released the fourteenth (#14) transmitter equipped steelhead using flyfishing gear at Hatwai Creek, km 11.2 (mi 7), on 23 September. The 99.1-cm (39-in) hatchery female fought for 45 minute prior to tagging. Water temperature and

discharge were 14.5 C (58.1 F) and 7,070 cfs, respectively. She remained in the riffle at the mouth of Hatwai Creek for 2 days after release then began moving upstream. We tracked her upstream progress as far as Cottonwood Creek, km 30.9 (mi 19.2), by 2 October and past Big Canyon Creek, km 56.5 (mi 35.1) on 5 October. After losing contact for 5 days, we relocated the hatchery female 500 m (547 yd) up the North Fork on 10 October. Her movement, through the lower Clearwater after release, took only 15 days before entering the North Fork, The fish moved back out of the North Fork and began moving upstream in the main Clearwater on 18 October. We monitored her position in the Slaughterhouse Pool, km 65.6 (mi 40.8) for the next 8 days then found her back in the North Fork at the base of Dworshak Dam on 30 October. We lost contact on the following day and I suspect an angler captured the fish.

Fish #14

Frequency	Location--river km		Date	Flows	Temp.	Remarks
4.35	Hatwai Creek	11.2	9-23	7070	14.5	HF #18
4.35	Hatwai Creek	11.3	9-24	6420	14.5	down 100 m
4.35	Hatwai Creek	11.2	9-25	3930	13.9	up 100 m
4.35	KAO pool	11.6	----	----	----	up 400 m
4.35	Hatwai Creek	11.3	9-26	7120	14.5	down 300 m
4.35	Coyote Fishnet	13.9	9-27	8200	13.9	0800 hrs
4.35	Hog Island	15.2	9-27	----	----	1730 hrs
4.35	Spalding bridge	17.1	9-27	----	----	1930 hrs
4.35	Spalding RR	20.3	9-28	10800	13.4	up 3.2 km
4.35	Myrtle Beach	28.8	10-1	10200	13.4	up 8.5 km
4.33	Cottonwood Creek	30.9	10-2	8970	13.4	0900 hrs
4.33	Mile Post 24	38.6	10-2	----	----	1700 hrs
4.43	Beverlyn's Rapids	57.2	10-5	5400	13.4	up 18.6 km
4.43	Lost		10-8	5200	13.4	- - -
4.43	Ahsahka bridge	65.1	10-10	5160	13.4	North Fork
4.43	Slaughterhouse	65.6	10-18	2560*	10.4	main river
4.43	Slaughterhouse	65.5	10-26	3620*	9.5	down 100 m
4.40	Dworshak tailrace	N.F.	10-30	2200**	14.0	North Fork
4.40	Lost		10-31	2200**	13.0	caught?

* Main river at Orofino
** North Fork

We equipped the last (#15) caught-and-released steelhead with a transmitter on 24 September below the Arrow Bridge, km 23.2 (mi 14.4). We caught the 91.4-cm (36-in) hatchery male trolling hotshots. River temperature and discharge were 14.7 C (58.5 F) and 6,420 cfs, respectively. After releasing the fish we attempted to verify the signal frequency from the boat using the receiver, headphones and loop antenna. We received a faint and erratic signal characterized by an increasingly, rapid pulse rate. I returned to the release site later in the day and was unable to pick up the signal from the tracking vehicle. While searching the following day, I picked up a high-pitched, steady signal 4 km (2.5 mi) downstream at Spalding Park. I continued to receive the steady, no-pulsating signal for 3 days at the same location prior to losing contact. I described the transmitter behavior to the manufacturer, and they indicated that a steady, non-pulsating signal was the typical response of a failing transmitter. We had no further contact with the fish in question until it appeared in the sports catch on 5 November. Project personnel

checked an angler with the hatchery male near the mouth of the North Fork, km 62.4 (mi 38.8) during routine creel census, Unfortunately, the fishermen only recovered the external dart-tag and failed to find the transmitter while cleaning his catch.

Fish #15

Frequency	Location--river km		Date	Flows	Temp.	Remarks
7.35	Arrow Bridge pool	23.2	9-24	6420	14.7	HM #16
7.35	Arrow Bridge pool	23.2	9-24			weak
7.35	Couldn't locate	23.2	9-24			1900 hrs.
7.35	Spalding Park	19.2	9-25	3930	14.0	steady signal
7.35	Spalding Park	19.2	9-28	10800	13.4	weak-steady
7.35	Couldn't locate	----	9-29	10900	13.4	lost
NA	Pink House Hole	62.4	11-5	5950	7.2	recaptured

Temporary Straying Behavior of Adult Dworshak Hatchery Steelhead

We began the second phase of radio-telemetry work with Clearwater steelhead in early November, 1977. We hoped to document straying behavior of adult hatchery fish which failed, for whatever reason, to return to the North Fork and continued upstream into the upper Clearwater drainage. Workers have previously reported steelhead of hatchery origin from upper Clearwater tributaries during spawning counts. Hatchery steelhead have been trapped in the electric weir at Kooskia National Fish Hatchery on Clear Creek (Pettit 1978). Evidence also exists which indicates that hatchery bypass occurs at a higher rate during years when adults return from smolt releases in the main Clearwater River. Since approximately 600,000 smolts went into the main river during the 1975 release, we felt the 1977 fall return would present an excellent opportunity to monitor straying behavior of Dworshak steelhead. The use of radio transmitters would enable us to not only document hatchery bypass, but also the timing and ultimate fate of hatchery adults during the 1978 spawning season.

Tagging started on 4 November and ended on 10 December. We captured, tagged-and-released, 12 adult hatchery steelhead above the North Fork. Workers released the radio-equipped fish between 12 km (5.4 mi) and 30.6 km (19,0 mi) above the North Fork confluence (Fig. 9). We captured all steelhead by trolling hotshots from a drift boat. We only tagged adults which showed obvious fin deformities and measured greater than 76 cm (30 in). During the 5-week tagging period, workers caught 18 steelhead and only 6 appeared wild. The 12 radio-equipped hatchery steelhead included 10 females and 2 males. Transmitter insertion occurred without the use of an anesthetic and we placed an external dart-tag next to the dorsal fin insertion. We offered a $10 reward to anglers who captured the dart-tagged steelhead and recovered the radio transmitters,

Workers attempted tracking individual steelhead every other day except during periods of extreme cold or hazardous road conditions. The close proximity of Highway 12 to the upper Clearwater River above Orofino made radio location an easy task in most instances. We did, however, experience some difficulty while attempting to monitor fish moving through the stretch of river above Kamiah where the highway leaves the river bank for a 4,8-km (3-mi) section.

The 1977-1978 winter conditions on the upper Clearwater above the North Fork

ranged between severe flooding and low, ice-covered flows. River levels and water temperatures dropped steadily in November. The river above the North Fork began running slush-ice on 19 November and slowly moving pools froze over on 20 November. Water temperatures reached 1.1 C (34 F) during the week ice remained on the river. A warm, chinook storm with heavy rains occurred in late November and the river began rising dramatically until cresting at 37,300 cfs on 3 December. Temperatures began reducing in mid-December and flows had dropped to below 4,000 cfs by 30 December. Water levels and temperatures remained low and relatively stable through the month of January. Pools and slower runs froze over again on 3 January and remained frozen until 14 January. A slight thaw during the second week of February raised flows and brought river temperatures above 5 C (41 F) for the first time. This trend continued through the months of February and March.

Movement and migratory behavior of the 12 hatchery steelhead tagged above the North Fork varied considerably. Except for several individuals which dropped downstream immediately after release, most movement occurred during periods of high or rising flows. Movement during February also appeared to be associated with increasing water temperatures. Four fish remained at the respective release sites for periods ranging between 49 and 103 days prior to moving. All 4 of these individuals initially began moving upstream and then returned back downstream and entered the North Fork. A fifth individual moved 4 km (2.3 mi) downstream during the late November flood where it remained until moving upstream 74 days later, Like the others, it eventually returned to the North Fork.

We tracked two fish downstream between 8 and 11 km (5-6.8 mi) immediately after tagging-and-release. One of these individuals held near Orofino for most of the winter, then began moving downstream past the North Fork until stopping below Bedrock Creek, We monitored the hatchery female at this location until it began moving back upstream and entered the North Fork on 15 March, The other individual apparently regurgitated its transmitter sometime after mid-December, since we continued to receive the transmitter signal from the same location after the female had successfully returned to the hatchery.

A third group of steelhead held at their respective release sites until the late November floods. We then tracked these 3 individuals downstream during the high flows. One fish dropped downstream and entered the North Fork on 30 November. It remained in the North Fork 66 days and then we tracked it back into the main river above the hatchery. The fish stayed above the hatchery in the Slaughterhouse pool, km 65.7 (mi 40.8), for 2 weeks and then returned to the North Fork on 22 February. The second steelhead which moved downstream during the late November-December flooding spent the winter near Orofino Creek. We then tracked it downstream into the Clearwater arm of Lower Granite Reservoir where contact was eventually lost in early June, The third fish remained at its release site until the flood in early December and then slowly dropped downstream until entering the North Fork on 2 January.

Two individuals began moving upstream during the high, turbid flows in late November. We tracked them upriver past Kamiah where they stopped moving until mid-January. Both continued upstream to the South Fork confluence where they remained until late January. We then tracked them downstream back to the North Fork in early March.

In summary, none of the radio-equipped hatchery fish which we tagged above the 'North Fork remained upstream and spawned in the upper Clearwater drainage. All but

a single individual eventually returned back downstream to the North Fork or the hatchery. Included with this group should be the hatchery female caught-and-released by project personnel near Turkey Island on 14 September. Like those fish we tagged-and-released above the North Fork, she bypassed the hatchery and moved upstream as far as Kamiah before returning to the North Fork in the spring. Both periods of intense movement were associated with rising, turbid water condition. Most individuals ceased moving when temperatures dropped below 3 C (27 F). From the results of the tracking study it would appear that the practice of releasing Dworshak smolts in the main Clearwater may increase the rate of adult bypass. However, the bypass behavior and straying upstream above the North Fork appears only temporary in nature. Most individuals remained in the North Fork for a short period prior to entering the hatchery ladder. These periods averaged 11 days in length, and ranged from 2 to 59 days.

I have illustrated the movement of the 12 radio-equipped fish during 5 months investigation in Figure 11. The vertical axis represents river miles and the horizontal axis time in months. As in the previous figure, horizontal lines depict periods of no movement. I have included an individual tracking-log for each of the 12 hatchery steelhead tagged above the North Fork in order that fish movement be related to flows and temperature.

Hatchery Bypass Tracking Log

We caught-and-released the first radio-equipped hatchery steelhead above the North Fork on 4 November. We released the 83.4-cm (33-in) female near Bear Creek, km 79.6 (mi 49.5). Like all fish tagged during the investigation, we caught this steelhead while trolling hotshots from a drift boat. We monitored her in the same pool until 26 November, when she dropped downstream to the Johnson Mill, km 74.1 (mi 46). We continued tracking her downstream during the early December flood until she entered the North Fork on 3 December. The female remained in the North Fork between the hatchery and Dworshak Dam until moving up to the Slaughterhouse, km 65.7 (mi 40.8), pool on 8 February. We tracked her upstream as far as the airport, km 69.4 (mi 43.1), on 20 February and then found the fish in the hatchery ladder 2 days later. We recovered the transmitter during spawning operations on 7 March.

Fish #1

Frequency	Location--river km		Date	Flows	Temp.	Remarks
6.50	Zan's pool tailout	79.6	11-4	3790	5.3	HF 33"
6.50	Bear Creek	79.5	11-11	3130	3.4	down 100 m
6.50	Bear Creek	79.4	11-23	1600	1.1	down 100 m
6.44	Bear Creek	79.4	11-25	2500	1.1	slush ice
6.48	Johnson Mill pool	74.1	11-26	3000	1.1	down 5.3 km
6.48	Riverside	67.7	11-27	4230	1.1	down 6.4 km
6.48	Riverside	67.7	11-28	5000	1.1	mud-ice
6.46	North Fork confluence	65.2	11-30	8870	3.3	down 2.5 km
6.44	North Fork	1.3	12-3	4400*	4.7	up 1.3 km
6.44	Dworshak tailrace	3.2	12-6	4100*	4.7	up 900 m
6.44	North Fork	2.0	12-27	9500*	4.5	down 1.2 km
6.44	North Fork	1.8	1-2	9800*	4.7	down 200 m
6.43	North Fork ramp	900m	1-6	9800*	4.5	intense fishery
6.44	North Fork ramp	900m	1-21	10000*	4.7	intense fishery

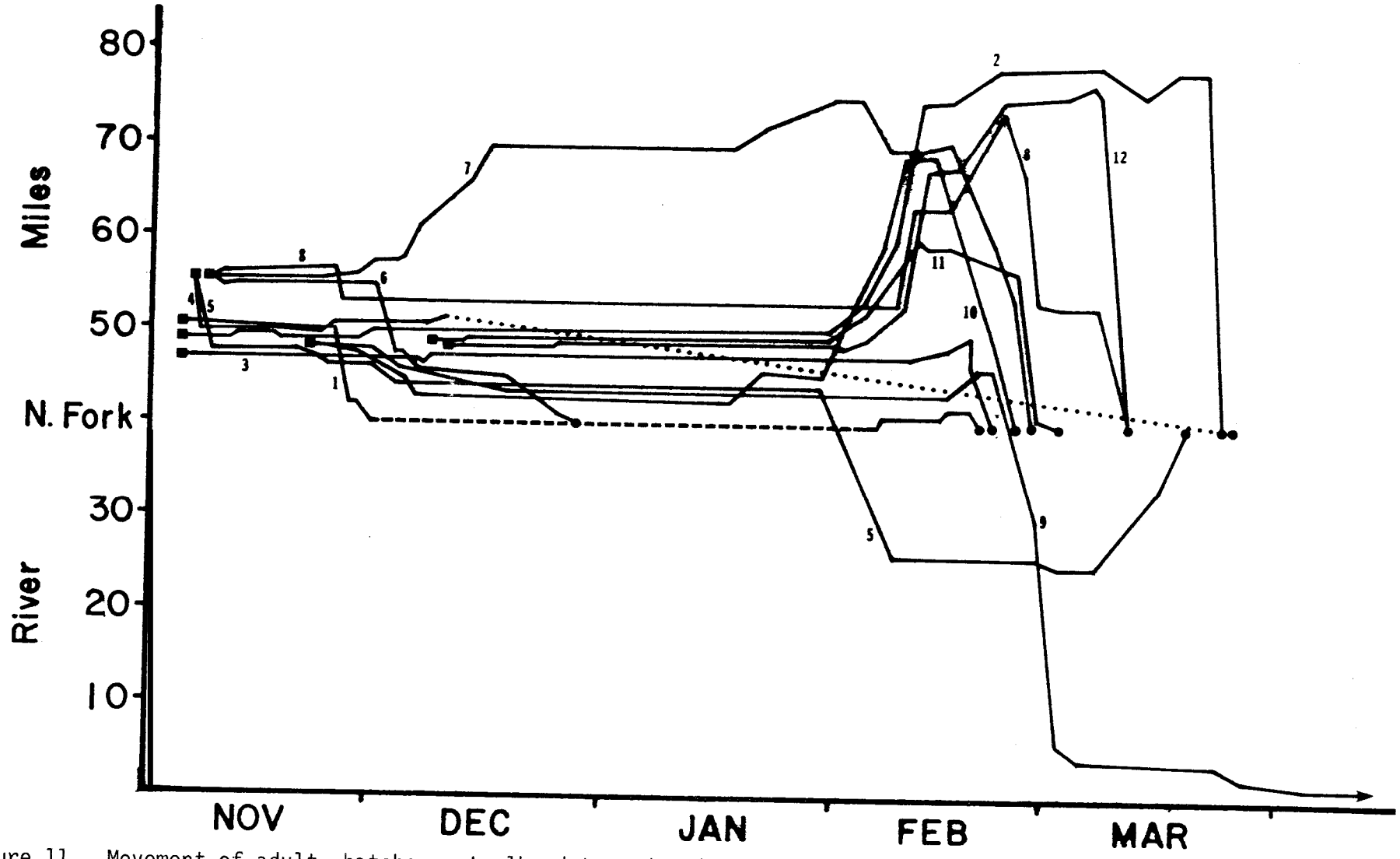

Figure 11. Movement of adult hatchery steelhead tagged and released by project anglers above the mouth of the North Fork on the main Clearwater River during the 1977-1978 fish year. Each fish was equipped with a miniature radio transmitter prior to release. Numerals associated with fish movements during the investigation correspond to the individual steelhead identified in the tracking log. Circles represent the date which hatchery steelhead returned to the North Fork of the Clearwater.

Fish #1 (Continued)

Frequency	Location--river km		Date	Flows	Temp.	Remarks
6.43	North Fork ramp	1 km	1-25	10000*	4.7	up 100 m
6.43	DNFH ladder	200 m	1-30	10000*	4.5	down 800 m
6.43	North Fork conf.	65.2	2-4	5940	4.6	main river
6.43	Slaughterhouse pool	65.7	2-8	9010	5.1	up 500 m
6.43	Slaughterhouse pool	----	2-15	5740	3.2	intense
6.43	Riverside-airport	69.4	2-20	5180	5.3	up 3.7 km
6.43	Entered DNFH	NA	2-22	NA	NA	down 4.4 km
6.43	Hatchery ponds	NA	3-3	NA	NA	sighted
6.43	Hatchery ponds	NA	3-7	NA	NA	spawned

*Dworshak discharge

We also tagged-and-released our second steelhead on 4 November at the mouth of Jim Ford Creek, km 78.4(mi 48.7). It was a 86.4-cm (34-in) hatchery male and fought for nearly 45 minutes prior to tagging. After release we continued to monitor the hatchery male in the Jim Fork Creek pool for the next 26 days. During the high turbid flows at the end of the month, the fish moved upstream into the next pool, km 78.8 (mi 49). We monitored him at this location until 30 January. He began moving upstream on 4 February and had reached the South Fork confluence by 11 February, km 120.2 (mi 74.7). He remained there for 4 days then moved further up the Middle Fork past Maggie Creek, km 125.6 (mi 78). We monitored him in the pool above Maggie Creek until 7 March. We began tracking the hatchery male back downstream on 11 March but found him back upstream at Maggie Creek on 15 March. The fish then moved downstream faster and longer than any of the steelhead tagged above the hatchery. After confirming his location above Maggie Creek on 19 March, I located him in the tailrace of Dworshak Dam on 21 March, a distance of 64 km (40 mi) in 24 hours. He remained in the North Fork for 7 days prior to entering Dworshak Hatchery.

Fish #2

Frequency	Location--river km		Date	Flows	Temp.	Remarks
6.25	Jim Ford Creek	78.4	11-4	3790	5.5	HM 34"
6.25	Jim Ford pool	78.2	11-11	3130	4.0	down 200 m
6.25	Jim Ford pool	78.5	11-16	4560	3.7	up 300 m
6.25	Jim Ford pool	78.2	11-18	3720	3.0	down 300 m
6.25	Jim Ford pool	78.2	11-28	5000	1.1	flows up
6.25	Mile post 48 pool	78.6	11-30	8870	3.3	up 400 m
6.25	Mile post 48 pool	78.8	1-2	3400	1.1	under ice
6.25	Mile post 48 pool	78.7	1-21	7340	4.8	flooding
6.23	Mile post 48 pool	78.7	1-30	5360	4.0	muddy
6.21	Greer Bridge	85.4	2-4	5940	4.6	up 6.7 km
6.21	Six Mile Creek	96.6	2-8	9010	5.1	up 11.2 km
6.21	South Fork	120.2	2-11	7600	4.6	up 23.6 km
6.22	South Fork	120.3	2-15	5740	3.2	up 100 m
6.22	Maggie Creek pool	125.6	2-21	5760	5.8	up 5.3 km
6.22	Maggie Creek pool	125.7	3-7	7300	5.9	up 100 m
6.22	Kooskia City ponds	121.3	3-11	1100	6.1	down 4.4 km

Fish #2 (Continued)

Frequency	Location--river	km	Date	Flows	Temp.	Remarks
6.22	Maggie Creek pool	125.6	3-15	8640	5.3	up 4.3 km
6.22	Maggie Creek pool	125.6	3-19	9840	7.1	- - -
6.22	Dworshak tailrace	N.F.	3-21	11200	7.5	down 63.6 km
6.22	Dowrshak tailrace	3.8	3-26	10000*	4.7	intense
6.22	Ahsahka bridge	400 m	3-28	10000*	4.7	down 2.8 km
6.22	Dworshak Hatchery	200 m	3-28	----	----	down 200 m
6.21	Hatchery ponds	NA	4-1	NA	NA	
6.21	Hatchery ponds	NA	4-9	NA	NA	
6.21	Lost	NA	4-10	NA	NA	not spawned

*Dworshak discharge

The third steelhead was caught-and-released on 4 November near the Orofino Gun Club range, km 74.6 (mi 46.4). The 91.4-cm (36-in) hatchery male fought approximately 30 minutes prior to tagging. We continued to monitor the large male in the Gun Club pool for the next 103 days. We observed some movement within the holding area but neither of the winter flood periods caused him to leave the Gun Club pool. We began tracking the hatchery male upstream on 21 February when we located him at Bear Creek, km 79.6 (mi 49.5). After tracking unsuccessfully upstream as far as the South Fork on 24 February, we located the fish in the hatchery ladder. We monitored him in the hatchery holding ponds for the next 33 days. I recovered the transmitter during spawning operations on 29 March.

Fish #3

Frequency	Location--river	km	Date	Flows	Temp.	Remarks
3.38	Orofino Gun Club	74.6	11-4	3790	5.4	HM 36"
3.38	Gun Club pool	74.5	11-5	3480	5.6	up 100 m
3.38	Gun Club pool	74.9	11-8	3500	5.3	up 400 m
3.38	Gun Club pool	74.8	11-23	1600	1.1	slush ice
3.38	Gun Club pool	74.7	12-6	13700	4.4	down 100 m
3.38	Gun Club pool	74.9	12-10	9350	0.9	up 200 m
3.38	Gun Club pool	74.9	1-10	6910	2.0	ice covered
3.38	Gun Club pool	74.8	1-17	6970	4.4	flooding
3.38	Gun Club riffle	75.0	2-10	8290	4.7	up 200 m
3.38	Gun Club riffle	75.1	2-15	5740	3.2	up 100 m
3.38	Bear Creek pool	79.6	2-21	5760	5.8	up 4.5 km
3.38	Gun Club pool	74.7	2-21	----	----	1830 hrs
3.38	Dworshak ladder	65.0	2-24	5480	4.7	down 9.7 km
3.38	Hatchery ponds	NA	3-2	NA	NA	sighted
3.38	Hatchery ponds	NA	3-29	NA	NA	spawned

We tagged the next 3 fish on 6 November. Number four (#4) was caught-and-released at Fivemile Creek, km 88.7 (mi 55.1). The 81.3-cm (32-in) hatchery female was adipose clipped. We located the female approximately 9 km (5.6 mi) downstream in the Bear Creek pool, km 79.4 (mi 49.3), 2 days later. She remained in the Bear Creek pool until 23 November when she dropped downstream into the next deep pool.

She began moving upstream on 28 November and held in the Zan's pool, km 80.2 (mi 49,8). We confirmed movement again on 9 December and observed the last monitored movement the following day. We continued to receive the transmitter signal from the tailout of Zan's pool for the next 137 days. I began to suspect that she had died until we recovered the fish at Dworshak Hatchery during spawning operations on 26 March. After identifying the female by its external dart tag we discovered that she had regurgitated the transmitter prior to returning to the hatchery. When, after 10 December, transmitter loss occurred is unknown. We successfully monitored transmission signals from the displaced module until June, when we stopped tracking,

Fish #4

Frequency	Location--river km		Date	Flows	Temp.	Remarks
10.20	Fivemile Creek pool	88.7	11-6	3480	6.1	HF 32" AD
10.20	Bear Cr. tailout	79.4	11-8	3500	5.3	down 9.3 km
10.20	Bear Cr. tailout	79.3	11-11	3130	4.9	down 100 m
10.20	Bear Cr, tailout	79.2	11-13	3030	4.7	down 100 m
10.20	Bear Cr. tailout	79.1	11-16	4560	3.1	down 150 m
10.23	Milepost 48 pool	79.0	11-23	1600	1.5	down 300 m
10.20	Zan's pool tailout	80.0	11-28	5000	1.1	up 1 km
10.20	Zan's pool	80.2	11-30	8870	3.3	up 200 m
10.20	Zan's pool	80.4	12-9	9680	0.9	up 200 m
10.19	Zan's pool	80.5	12-10	9350	0.9	up 100 m
10.19	Zan's pool	80.4	3-25	17400	7.3	- - -
NS	Dworshak Hatchery	65.0	3-26	NA	NA	lost tag

We tagged the fifth fish at Fivemile Creek on 6 November. The 81.4-cm (32-in) hatchery female had dropped downstream 13 km (8 mi) 2 days later. We located her near the Ceder mill, km 75.7 (mi 47), on 8 November and down further at the Gun Club pool, km 75.0 (mi 46.6), by 23 November. During the late November flood we tracked her down to the pool above Orofino Creek, km 72.6 (mi 45.1), where she remained for the next 2 months. We lost contact on 4 February and tracked unsuccessfully upstream to the Selway River, km 157.0 (mi 97.6), only to relocate the female in Squaw Rapids, km 41.6 (mi 25.8), below Bedrock Creek on 8 February. She remained below Squaw Rapids for 27 days. We began tracking her back upstream on 11 March and she entered the hatchery on 19 March. We recovered the transmitter during spawning operations on 21 March.

Fish #5

Frequency	Location--river km		Date	Flows	Temp.	Remarks
9.20	Fivemile Creel pool	88.7	11-6	3480	6.1	HF 32"
9.20	Ceder mill run	75.7	11-8	3500	5.3	down 13 km
9.20	Ceder mill run	75.4	11-20	2160	1.5	slush-ice
9.20	Gun Club pool	75.1	11-23	1600	1.1	down 300 m
9.20	Johnson mill	74.1	11-26	3000	1.1	flooding-ice
9.24	Johnson mill	73,7	11-27	4230	1.1	down 400 m
9.24	Johnson mill	73.6	11-30	8870	3.3	down 100 m

Fish #5 (Continued)

Frequency	Location--river km		Date	Flows	Temp.	Remarks
9.24	Orofino Creek	72.6	12-3	37300	2.8	down 1 km
9.21	Orofino Creek	72.5	12-14	19900	3.3	down 100 m
9.21	Orofino Creek	72.5	1-30	5000	3.7	- - -
9.20	Couldn't locate	----	2-4	5940		
9.20	Squaw Rapids	41.6	2-8	24600*	3.4	down 30.9 km
9.20	Squaw Rapids	41.2	2-27	22300*	5.6	down 400 m
9.20	Windmill pool	40.3	3-2	18600*	4.7	down 900 m
9.20	Windmill pool	40.5	3-7	19400*	6.1	up 200 m
9.20	Mile post 33	53.9	3-15	21000*	7.2	up 13.4 km
9.20	Dworshak Hatchery	65.3	3-19	21400*	8.3	up 11.4 km
9.20	Hatchery ponds	NA	3-21	NA	NA	spawned

*Spalding guage

We caught the sixth (#6) radio-equipped hatchery fish in the Fivemill Creek pool, km 88.9 (mi 55.2), on 8 November. The 76.2-cm (30-in) female was the only fish tagged during the investigation where we questioned our determination of origin. However, the female returned to the North Fork and we suspect our identification was correct. She remained in the Fivemile Creek pool until 30 November and then dropped downstream to the Ceder mill run, km 75.7 (mi 47), on 3 December. We monitored her at this location for the next 12 days. The female dropped downstream to the Johnson Mill pool, km 74.3 (mi 46.2), on 18 December and then moved upstream 500 m (528 yd) to the Gun Club pool on 20 December. We located her **in** the Slaughterhouse pool, km 65.7 (mi 40.8), on 24 December and tracked her into the North Fork on 2 January. She remained in the North Fork until we lost contact on 10 January. We searched unsuccessfully between Lewiston and the Selway River and suspect an angler caught it while fishing in the North Fork.

Fish #6

Frequency	Location--river km		Date	Flows	Temp.	Remarks
4.20	Fivemile Creek pool	88.9	11-8	3500	4.8	HF 30"
4.20	Fivemile Creek pool	90.1	11-10	2940	4.8	up 200 m
4.20	Fivemile Creek pool	90.1	11-18	3720	3.0	- - -
4.20	Fivemile Creek	88.8	11-23	1600	1.1	ice covered
4.19	Fivemile Creek	88.7	11-30	9100	3.3	down 300 m
4.18	Ceder mill run	75.7	12-3	37300	2.8	flooding
4.18	Ceder mill run	----	12-4	25400	4.0	down 13 km
4.18	Orofino Gun Club	75.0	12-6	13700	4.4	up 200 m
4.18	Orofino Gun Club	----	12-15	21700	3.3	- - -
4.18	Johnson Mill pool	74.1	12-18	14700	3.7	down 1.9 km
4.16	Gun Club pool	75.0	12-20	10500	3.5	up 900 m
4.16	Slaughterhouse pool	65.7	12-24	8040	3.0	down 9.3 km
4.16	Dworshak Hatchery	65.3	12-27	6410	3.0	down 400 m
4.16	North Fork	300 m	1-2	9000*	1.1	up 300 m
4.16	North Fork	400 m	1-6	10000*	2.2	up 100 m
4.16	Couldn't locate	----	1-10	10000*	2.0	caught?

*Dworshak discharge

We tagged and released the seventh (#7) steelhead on 8 November at Fivemile Creek, km 88.7 (mi 55.1). The 86.4-cm (34-in) adipose clipped, hatchery female fought for 15 minutes prior to tagging. After release we monitored the female in the Fivemile Creek pool for 20 days. We began tracking her upstream on 30 November when the ice-cover on the Fivemile Creek pool broke up. She moved rapidly upriver during the early December flood until she reached the islands above Kamiah, km 112,0 (mi 69.6), on 15 December. The hatchery female remained near the islands until 17 January when she began moving upstream again. We located her at the South Fork confluence on 30 January where she remained until 4 February. On 8 February we located her back downstream near the Kamiah islands where she stayed until 15 February. We then tracked her downriver until she entered the North Fork on 27 February. She remained in the North Fork for 20 days prior to climbing the hatchery ladder on 19 March. We recovered the transmitter on 21 March during spawning operations.

Fish #7

Frequency	Location--river km		Date	Flows	Temp.	Remarks
7.25	Fivemile Creek pool	88.7	11-8	3500	4.8	HF 34" -AD
7.25	Fivemile Creek pool	90.0	11-10	2940	4.8	up 300 m
7.25	Fivemile Creek pool	88.9	11-20	2160	1.5	down 100 m
7.24	Fivemile Creek pool	88.8	11-23	1600	1.1	under ice
7.24	Fivemile confluence	88.9	11-28	5000	1.1	ice out
7.23	Tunnel pool	91.9	11-30	8870	3.3	up 2.2 km
7.22	Tunnel pool	91.1	12-3	37300	2.8	- - -
7.22	Mile post 56 pool	92.7	12-4	25400	4.0	up 1 km
7.22	Sixmile Creek	98.2	12-6	13700	4.4	up 5.5 km
7.22	Kamiah RR bridge	106.2	12-13	9880	3.8	up 8 km
7.22	Kamiah islands	112.0	12-15	21700	3.3	up 5.8 km
7.23	Kamiah islands	----	1-17	6970	4.4	- - -
7.22	Mile post 71 pool	115.8	1-21	7340	4.8	up 3.8 km
7.23	Kooskia bridge	120.4	1-30	5360	4.0	up 4.6 km
7.21	Kooskia bridge	____	2-4	5940	4.6	- - -
7.21	Kamiah islands	111.8	2-8	9010	4.8	down 8.6 km
7.21	Kamiah islands	____	2-11	7600	4.6	- - -
7.21	Upper islands	112.6	2-15	5740	3.2	up 800 m
7.21	Sixmile Creek	94.8	2-21	5760	5.8	down 17.8 km
7.21	Lolo Creek	87.1	2-24	5480	5.2	down 7.7 km
7.21	North Forkconfluence	65.2	2-27	5880	5.8	down 22 km
7.21	North Fork launch	700 m	3-2	10000*	4.9	intense fishery
7.21	Ahsahka Bridge	400 m	3-5	10000*	5.0	down 300 m
7.21	Hatchery intake	300 m	3-11	10000*	4.9	down 100 m
7.21	North Fork launch	900 m	3-15	9800*	5.0	up 600 m
7.21	Hatchery ladder	200 m	3-19	9800*	5.0	in ladder
7.21	Hatchery ponds	NA	3-21	NA	NA	spawned

*Dworshak discharge

We caught-and-released the eighth (#8) radio-equipped hatchery steelhead on 8 November at Fivemile Creek, km 88.7 (mi 55.1). The 78.8-cm (31-in) female remained in the Fivemile pool until 25 November. When the ice-breakup and flooding occurred on 26 November we tracked her downstream to the pool above Greer, km 85.3 (mi 53). We monitored the female at this location for 74 days. We began tracking her upstream

on 11 February until she stopped at the South Fork confluence on 21 February. Four days later we located the fish downstream at the Kamiah Bridge, km 108.1 (mi 67.2). We continued tracking her progress back downstream until she entered the North Fork on 15 March. She remained in the river near the hatchery ladder entrance for 11 days, then moved up to the dam tailrace on 28 March. We found the female in the hatchery on 1 April and recovered the transmitter during spawning operations a week later.

Fish #8

Frequency	Location--river km		Date	Flows	Temp.	Remarks
5.24	Fivemile Creek pool	88.7	11-8	3500	4.8	HF 31"
5.23	Fivemile Creek pool	88.9	11-11	3130	4.9	up 200 m
5.22	Fivemile Creek pool	88.4	11-20	2160	1.5	slush ice
5.22	Fivemile Creek pool	88.4	11-25	2500	1.1	thawing
5.26	Greer beach pool	85.3	11-26	3000	1.1	down 3.1 km
5.18	Greer beach pool	85.2	12-7	13300	1.0	down 100 m
5.19	Greer beach pool	85.4	12-12	9880	1.0	up 150 m
5.20	Greer beach pool	85.4	2-8	9010	5.1	very muddy
5.20	Sixmile Creek pool	102.2	2-11	7600	4.6	up 16.8 km
5.20	Sixmile Creek pool	102.3	2-15	5740	3.2	up 100 m
5.18	South Fork confluence	120.2	2-21	5760	5.8	up 17.9 km
5.18	Kamiah Bridge pool	108.0	2-24	5480	5.2	down 12.2 km
5.18	Greer Reststop	85.8	2-27	9300	5.8	down 22.2
5.18	Greer beach pool	85.3	3-2	7500	4.7	down 500 m
5.18	Greer beach pool	----	3-7	7300	5.9	- - -
5.17	North Fork	200 m	3-11	10000*	5.0	down 20 km
5.17	Hatchery ladder	200 m	3-26	10000*	5.1	- - -
5.18	Ahsahka Bridge	400 m	3-28	8500*	5.0	up 200 m
5.19	Dworshak tailrace	3.2	3-28	----	---	up 2.8 km
5.18	Hatchery ladder	200 m	4-1	10000*	5.5	down 3 km
5.18	Hatchery ponds	----	4-8	----	---	spawned

*Dworshak discharge

Our ninth (#9) radio-equipped steelhead was caught-and-released on 19 November near Bear Creek, km 79.5 (mi 49.4). The 77.5-cm 01,5-in) adipose-clipped, hatchery female fought only 5 minutes due to the cold water temperatures, 1.5 C (34.7 F). We tracked the fish downstream to the next pool immediately after release where she remained until 30 November. She began moving downstream during the early December flooding and reached the Orofino Bridge pool on 9 December, km 71.9 (mi 44.7). We monitored her position in the run below the bridge for the next 2 months. The female began moving upstream on 4 February until holding at the Johnson Mill above Orofino, km 74.5 (mi 46.3). She began dropping back downstream on 24 February but failed to enter the North Fork, We tracked her into the lower Clearwater River until she stopped in the Lower Granite arm of the reservoir. We continued monitoring her as she slowly dropped downstream towards the confluence. Contact was lost on 5 May and a search upstream to the North Fork proved unsuccessful. I suspect the hatchery female left the Clearwater and either moved upstream into the Salmon River or dropped downstream into the Snake River system.

Fish #9

Frequency	Location--river km		Date	Flows	Temp.	Remarks
11.20	Bear Creek pool	79.5	11-19	3120	1.3	HF 30-AD
11.20	Mile post 48 pool	78.6	11-20	2160	1.5	down 900 m
11.25	Mile post 48 pool	----	11-23	1500	.8	slush ice
11.23	Mile post 48 pool	----	11-30	8870	3.3	flooding-ice
11.22	Jim Ford Creek	78.2	12-3	37300	2.8	down 400 m
11.20	Orofino Golf Club	75.0	12-4	25400	4.0	down 3.2 km
11.20	Orofino Bridge pool	72.0	12-9	9680	4.8	down 3 km
11.20	Orofino Creek	72.1	12-10	9350	0.9	up 100 m
11.20	Orofino Bridge	71.6	12-18	14700	3.7	down 500 m
11.20	Orofino Bridge	72.0	2-4	5940	4.6	up 400 m
11.20	Orofino Creek	72.2	2-15	5740	3.2	up 200 m
11.20	Johnson Mill pool	74.1	2-19	4740	4.0	up 1.9 km
11.20	Johnson Mill pool	----	2-21	5760	5.8	muddy
11.20	Orofino Creek pool	72.1	2-24	5480	5.2	down 2 km
11.20	Mile post 30 pool	48.3	2-27	22300*	5.8	down 23.8 km
11.20	Hatwai Creek	10.5	3-2	18600*	5.0	down 37.8 km
11.20	PFI Mill	5.9	3-5	19200*	5.0	down 4.6 km
11.20	PFI Mill	5.3	3-23	26000*	7.2	down 600 m
11.20	Clearwater Bridge	3.2	3-27	28900*	7.8	down 2.1 km
11.20	Lewiston RR bridge	1.5	4-3	31000*	7.9	down 1.7 km
11.20	Lewiston RR bridge	----	5-5	37000*	8.6	last contact

*Spalding guage

We equipped the tenth (#10) hatchery steelhead with a transmitter on 19 November at Bear Creek km 79.4 (mi 49.3). The 79.2-cm (31-in) hatchery female fought poorly due to 1.5 C (34.7 F) water temperatures. The fish dropped downstream to Jim Ford Creek immediately after release and remained there for the next week. We began tracking it downstream on 28 November until stopping at the Riverside Cemetery km 71.3 (mi 44.3), below the Orofino Bridge. We monitored the fish at this location until 17 January, a period of 42 days. It started moving upstream on 21 January and reached the Kamiah islands, km 112.0 (mi 69.6) on 11 February. We began tracking it back downstream on 21 February and located the female in the North Fork 3 days later. It remained in the North Fork for 15 days prior to entering the hatchery on 11 March. We recovered the transmitter on 14 March during spawning operations.

Fish #10

Frequency	Location--river km		Date	Flows	Temp.	Remarks
3.14	Bear Creek tailout	79.3	11-19	3120	1.5	HF 31"
3.13	Jim Ford Creek pool	78.3	11-20	2160	1.5	down 1 km
3.15	Jim Ford Creek pool	----	11-27	4230	1.1	slush ice-mud
3.17	Orofino Golf Course	77.2	11-28	5000	1.1	down 1.1 km
3.15	Ceder mill run	75.7	11-30	8870	1.1	down 1.5 km
3.15	Gun Club pool	75.0	12-3	37300	2.8	down 700 m
3.15	RR Tunnel hole	73.7	12-4	25400	4.0	down 1.3 km
3.15	Riverside Cemetery	71.3	12-6	13700	4.8	down 2.4 km

Fish #10 (Continued)

Frequency	Location--river km		Date	Flows	Temp.	Remarks
3.15	Riverside Cemetery	----	12-27	6410	3.0	- - -
3.15	Riverside Cemetery	71.0	1-17	6970	4.4	down 300 m
3.15	Johnson Mill pool	74.1	1-21	7340	4.8	up 3.1 km
3.14	Johnson Mill pool	74.5	1-30	5000	3.7	up 400 m
3.14	Lolo Creek	87.1	2-4	5940	4.6	
3.14	Sixmile Creek	95.7	2-8	9010	5.1	up 8.6 km
3.14	Kamiah islands	112.0	2-11	7600	4.6	up 16.3 km
3.14	Kamiah islands	112.5	2-15	5740	3.2	up 500 m
3.14	Jim Ford Creek	78.6	2-21	5760	5.8	down 33.9 km
3.14	North Forkconfluence	65.2	2-24	5480	5.2	down 13.4 km
3.14	North Fork confluence	----	2-27	9500*	5.5	intense
3.14	Dworshak tailrace	3.2	3-5	10000*	5.7	up 3.2 km
3.14	Ahsahka Bridge	400 m	3-7	10000*	5.5	down 2.8 km
3.14	Dworshak ladder	200 m	3-11	10000*	5.8	down 200 m
3.14	Hatchery ponds	----	3-14	NA	NA	spawned

*Dworshak discharge

The eleventh (#11) radio-equipped steelhead was released at Jim Ford Creek, km 78.2 (mi 48.6) on 8 December. The 83.8-cm (33-in) hatchery female remained in the Jim Ford pool until early February. We began tracking her upstream on 4 February. We located the fish moving past Sixmile Creek on 11 February and found her downstream from Sixmile Creek on 21 February. We continued tracking her back downstream to the North Fork on 2 March. Contact was lost 3 days later and I suspect that steelhead anglers captured the female but failed to find the tag or transmitter.

Fish #11

Frequency	Location--river km		Date	Flows	Temp.	Remarks
1.32	Jim Ford Creek	78.2	12-8	11300		HF 33"
1.32	Jim Ford Creek	78.2	12-10	9350	0.9	- - -
1.32	Upper Jim Ford pool	78.4	12-13	10600	3.8	up 200 m
1.32	Upper Jim Ford pool	78.4	1-2	3400	1.1	ice covered
1.32	Upper Jim Ford pool	78.4	1-30	5000	4.0	- - -
1.33	Greer Bridge pool	83.8	2-4	5940	4.6	up 5.4 km
1.33	Sixmile Creek	96.5	2-11	7600	4.6	up 12.7 km
1.33	Mile post 59 pool	95.7	2-15	5740	3.2	down 800 m
1.33	Mile post 57 pool	91.7	2-21	5760	5.8	down 4 km
1.33	Tunnel Run pool	91.1	2-24	5480	5.2	down 600 m
1.33	Slaughterhouse pool	65.7	2-27	9300	5.8	down 25 km
1.33	North Fork conf.	65.2	3-2	6790	4.7	down 500 m
1.33	Couldn't locate	----	3-5	7140	4.2	caught?

The final radio-equipped steelhead (#12) was released at Jim Ford Creek, km 78.1 (mi 48.6), on 10 December. The 80.0-cm (31.5-in) adipose clipped female was captured during high, muddy flows and remained at the release site for the next 7 weeks. On

4 February we began tracking her upstream. She reached the South Fork confluence on 21 February and remained there until 2 March. We located the fish near the mouth of Clear Creek, km 124.0 (mi 77.1) on 5 March and back downstream at the Kooskia sewage ponds 2 days later. We found the female entering the North Fork on 11 March where she remained until we lost contact on 15 April. I assume the fish was caught by an angler.

Fish #12

*Dworshak discharge

Frequency	Location--river	km	Date	Flows	Temp.	Remarks
4.41	Jim Ford Creek	78.1	12-10	9350	0.9	HF 31" AD
4.40	Jim Ford Creek	78.2	12-24	8040	3.0	up 100 m
4.36	Jim Ford Creek	78.3	1-2	3400	1.1	ice covered
4.40	Jim Ford tailout	78.0	1-30	5000	3.7	down 300 m
4.38	Mile post 48 pool	78.5	2-4	5940	4.6	up 500 m
4.38	Greer Bridge	84.6	2-8	9010	5.1	up 6.1 km
4.38	Kamiah Bridge	108.1	2-11	7600	4.6	up 23.5 km
4.38	Kamiah Bridge	108.2	2-15	5740	3.2	up 100 m
4.38	South Fork	120.2	2-21	5760	5.8	up 12 km
4.38	South Fork	120.4	3-2	7500	4.7	up 200 m
4.38	Clear Creek pool	124.0	3-6	8280	5.4	up 3.6 km
4.38	Kooskia ponds	121.4	3-7	8910	5.9	down 2.6 km
4.38	North Fork conf.	65.2	3-11	7600	6.1	down 56.2 km
4.39	North Fork	1.2	3-15	10000*	5.0	up 1 km
4.39	North Fork	----	3-28	8600*	5.3	intense fishery
4.40	Dworshak tailrace	3.1	4-1	8500*	5.5	up 1.9 km
4.39	Ahsahka Bridge	400 m	4-9	8500*	5.2	down 2.7 km
4.3	North Fork launch	700 m	4-15	8900*	5.4	up 400 m
4.	Couldn't locate	----	4-17	9000*	5.6	caught?

*Dworshak discharge

1978 Fall Steelhead Season

Anglers fishing the lower Clearwater during the fall of 1978 experienced their third nonconsumptive steelhead season in the last 4 years. Steelhead passage over Bonneville Dam reached an all time record low for July and August 1978. Escapement predictions for Idaho's Snake River tributaries based on lower river dam counts and from 1978 returns of 1-ocean adults at Dworshak National Fish Hatchery led biologists to recommend nonconsumptive regulations for the fall season. The Idaho Fish and Game Commission met in September and established a 90-day catch-and-release steelhead season on all drainages. The lower Clearwater season began on 30 September and continued through 31 December. As in previous catch-and-release steelhead fisheries, regulations required fishermen to immediately release all steelhead. The use of single, barbless hooks on artificial lures and flies was mandatory. Regulations also prohibited the use of bait, and unlike previous regulations, made bait fishing illegal for any species in all waters open to steelhead angling.

Fishing conditions on the lower Clearwater River during the fall of 1978 proved nearly perfect over the entire season. Lower than normal amounts of precipitation and reduced discharge from Dworshak Dam during October and early November kept river

levels below 0.9 m (3.0 ft) at Spalding, Discharge from Dworshak dropped to 1,000 cfs (spill) on 16 October, and continued for the next 20 days while construction in the powerhouse prevented the use of the generators, River conditions during this period were reminiscent of the flows experienced by anglers in 1971 while Dworshak Reservoir filled. Flows increased after 15 November, but remained clear and lower than normal for the remainder of the fall season.

We estimated that steelhead anglers spent a total of 10,935 hours to catch-and-release 2,465 summer steelhead for an average catch rate of 4.4 hours per fish (Fig. 3). These estimates include 1,375 hours spent by Nez Perce tribal fishermen while harvesting an estimated 236 steelhead (Table 11). The 1978 catch-and-release census statistics continued to illustrate the exceptionally high levels of success enjoyed by relatively few anglers during a nonconsumptive steelhead fishery.

The lower than normal flows provided excellent conditions for shore anglers in 1978. We estimated that anglers fishing from shore spent 3,568 hours to catch-and-release approximately 631 summer steelhead for an average catch rate of 5.6 hours per fish (Table 11).

We found 1978 estimates for shore angler effort nearly identical to hours spent during the last nonconsumptive fishery in 1976. Catch rates were also similar; however, anglers in 1976 had slightly higher catch rates (Fig. 4),

We found boat anglers spent approximately 6,000 hours to catch-and-release an estimated 1,600 summer steelhead for an average catch rate of 3.8 hours per fish (Table 11). The extremely high rate of success by boat anglers in 1978 was the best yet recorded during a fall season (Fig. 4). The 1978 low water conditions made navigation hazardous; and most likely contributed to the reduced effort and high catch rates experienced by boat anglers. We estimated that boat anglers accounted for approximately 55% of the fall fishing effort (Table 2). Census estimates also indicated that boaters caught-and-released 65% of the steelhead during the 1978 fall fishery.

We estimated that Nez Perce tribal fishermen spent 1,375 hours to catch 236 steelhead for a 5.8 hour per fish success rate (Table 11). Although fishing conditions proved excellent in 1978, tribal anglers spent less time fishing and caught 140 fewer steelhead than during 1976 (Pettit 1978).

As in previous catch-and-release seasons, angling effort dropped significantly in mid-November when flows increased and weather conditions worsened. In 1978, shore anglers spent 81% of their total effort prior to mid-November while boat anglers spent 70% of their effort during the same period.

The exceptionally high rate of success enjoyed by steelhead fishermen during the 1978 catch-and-release season resulted from a combination of three factors. First, we again observed a shift in angler skill levels towards the more experienced and knowledgeable steelheader. Nonconsumptive steelhead regulations on the lower Clearwater have been more readily accepted by the so-called expert angler. This observation has undoubtedly resulted in higher success rates than we would normally associate with reduced levels of escapement. We also believe that reduced levels of angler competition, and the corresponding reduction of the "harassment" factor to the holding population of steelhead greatly improves success (Pettit 1978). Secondly, nearly perfect river conditions existed during the 1978 fall season. However, a third factor should be considered when explaining angler success **in** 1978. Because

Table 11 . Estimated effort, harvest and average catch rates per 2-week interval during the 1978 fall steelhead season on the lower Clearwater River. The estimates for Nez Perce tribal fishermen are also included for shore anglers.

Interval	Shore anglers						Boat anglers		
	Hours		~Catch		H/F		Hours	Catch	H/F
30 Sept. to 13 Oct.	870	318[a]	175	64[b]	5.0	5.0[c]	1,572	522	3.0
14 Oct. to 27 Oct.	1,306	518	284	88	4.6	5.9	1,476	378	3.9
28 Oct. to 10 Nov.	723	254	106	38	6.8	6.9	1,152	170	5.4
11 Nov. to 24 Nov.	239	169	35	20	6.8	8.5	407	17	12.1
25 Nov. to 8 Dec.	128	63	8	5	17.3	12.3	461	141	3.3
9 to 31 Dec.	302	53	23	21	12.3	2.5	924	370	2.5
Totals	3,568	1,375	631	236	5.6	5.8	5,992	1,598	3.8

[a]Estimated effort by Nez Perce tribal members
[b]Estimated harvest by Nez Perce tribal members
[c]Estimated catch rates by Nez Perce tribal members

of the extremely poor steelhead escapement to the Snake River during July, August and early September, we underestimated the number of B-run Dworshak adults returning to the Clearwater. Unfortunately, we did not have data which indicated the true strength of B-run steelhead escapement until late November and early December. Naturally, a larger Clearwater escapement than had been originally predicted, would have resulted in increased catch rates.

During the 1978 fall catch-and-release season, approximately 37% of the anglers interviewed were flyfishermen (Table 12). We also found that during the first 6 weeks of the 3-month season, flyfishermen made up as high as 54% of those interviewed during the fall season.

Resident anglers accounted for 59% of the angler interviews made during the 1978 season. Nez Perce tribal members made up 14%. Nonresident anglers interviewed accounted for 27%, predominantly from Washington, Montana and California (Table 12). Most interviews made by census clerks occurred in Area-II.

1979 Spring Steelhead Fishery

Information provided by National Marine Fisheries Service workers in mid-December, indicated that numbers of large B-run steelhead crossing Lower Granite Dam were greater than had been anticipated. Estimates indicated that 10,000 to 12,000 Dworshak Hatchery steelhead could be present in the Clearwater River. Therefore, after restricting anglers to a catch-and-release fishery during the 1978 fall season, the Idaho Fish and Game Commission established a catch-and-keep spring season from 20 January through 15 April 1979.

Extremely cold weather and minimal releases from Dworshak Dam during the first 3 weeks of the season resulted in low, clear water in the lower Clearwater River, and catch rates were good to excellent (10-15 hours per fish). Warming temperatures resulted in low elevation snow melt, and this combined with ice flows from the Middle Fork Clearwater made for very poor steelhead fishing from 10 February through 1 March. The main Clearwater had cleared substantially by the weekend of 3 March and catch rates improved to around 20 hours per steelhead. From 10 March until seasons end, 90% of the anglers were concentrated from Peck upstream in the main Clearwater and in the North Fork Clearwater (Fig. 12). Catch rates remained at around 25 hours per fish from mid-March until mid-April.

By mid-April, the 3,000 adult steelhead needed to meet egg take requirements had entered Dworshak Hatchery. In order to give anglers an additional chance to harvest the surplus steelhead, the Commission extended the season from 15 April through 30 April. Unfortunately, the main Clearwater was high and turbid during the 2-week extension; and, although numerous steelhead could be seen jumping in the North Fork, catch rates were very poor at 60 to 70 hours per fish.

During the spring 1979 steelhead season (20 January through 30 April 1979), we estimated that anglers fished a total of 112,660 hours on the lower Clearwater River to harvest 4,609 steelhead for an overall average catch rate of 24.4 hours per fish. Boat anglers fished 57,786 hours and harvested 2,545 steelhead. They also released an additional 293 steelhead for an average catch rate of 20.3 hours per fish. Anglers fishing from shore expended an estimated 54,874 hours to harvest 2,064 steelhead. They released 71 steelhead which brings the average catch rate to 25.7 hours per fish (Table 13).

Table 12. Summary of angler interviews during the 1978 fall steelhead season on the lower Clearwater River.

	Number	Percent
Angler interviews		
Residents	573	59
Nez Perce Indians	133	14
Non-residents	264	27
Washington	137	14
Montana	84	9
Other states	43	4
Steelhead released		
Area I	109	17
Area II	372	57
Area III	164	25
Area IV	3	1
Angling methods		
Shore anglers	575	59
Lures	350	61
Flies	213	37
*Bait	12	2
Boat anglers	395	41
Lures	395	100

*Nez Perce tribal members only

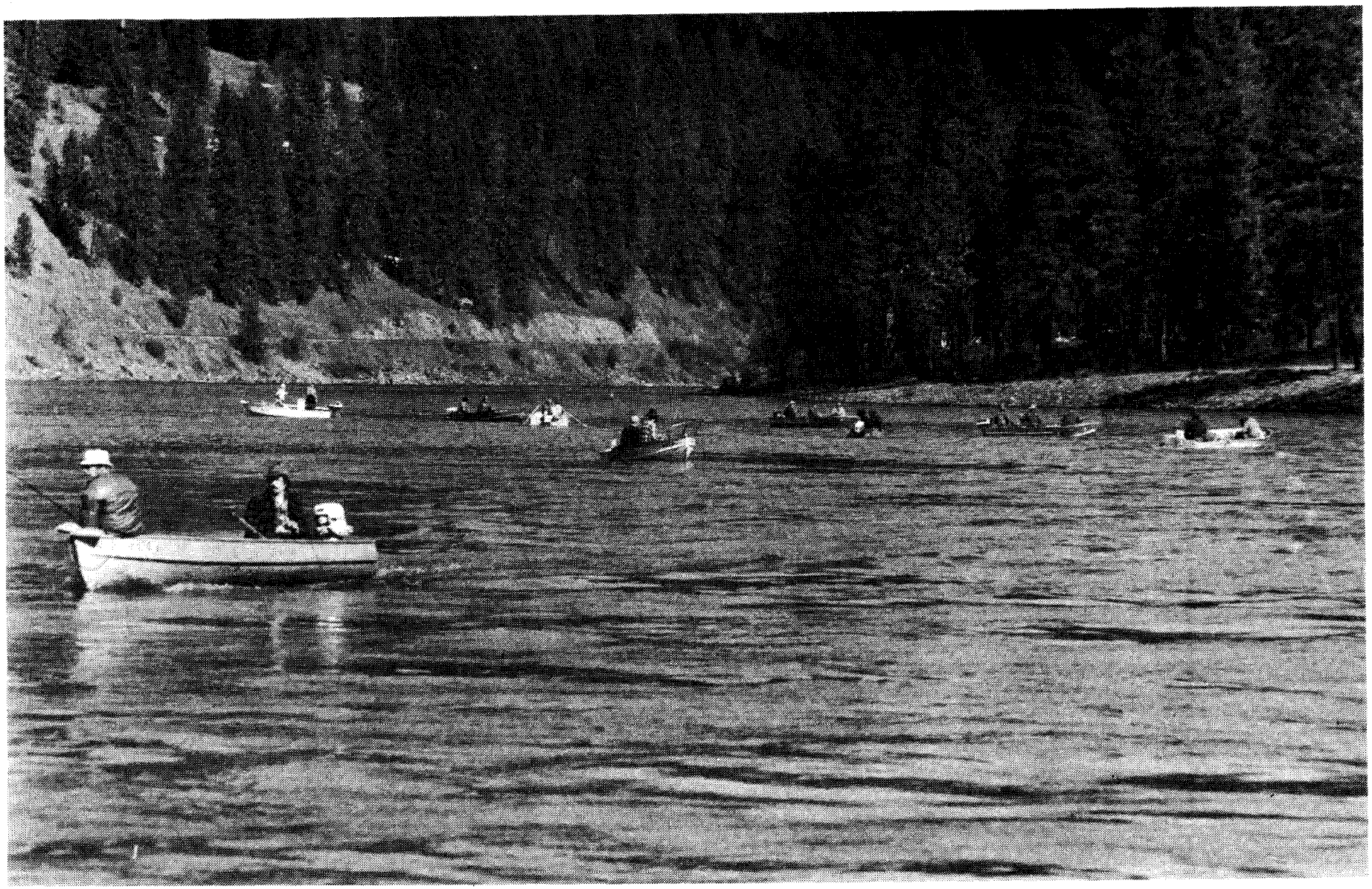

Figure 12. Steelhead anglers fishing from boats near the mouth of the North Fork on the lower Clearwater River during the 1979 spring season.

Table 13. Estimated effort, harvest and average catch rates per 2-week census intervals during the spring steelhead season on the lower Clearwater River, 1979.

Interval	Boat anglers			Shore anglers		
	Hours	Catch	H/1=	Hours	Catch	H/F
20 Jan.- 2 Feb.	10,142	841 (111)*	10.7	8,188	449 (9)*	17.9
3 Feb.-16 Feb.	9,168	417 (75)	18.6	6,555	189 (8)	33.3
17 Feb.-2 Mar.	5,277	128	41.2	4,600	88	52.3
3 Mar.-16 Mar.	7,203	317 (8)	22.2	7,315	372 (9)	19.2
17 Mar.-30 Mar.	10,354	332 (63)	26.2	10,534	383	27.5
31 Mar.-13 Apr.	11,588	445 (41)	23.8	11,756	475 (26)	23.5
14 Apr.-30 Apr.	4,054	65	62.4	5,926	108 (19)	46.7
Totals	57,786	2,545 (298)*	20.3	54,874	2,064 (71)*	25.7

*Estimated steelhead released

Comparing the 1979 spring steelhead season on the Clearwater River with previous years, we find that the 57,786 hours of effort expended by boat anglers surpassed the previous high established in 1978 by more than 15,000 hours. Because of the tremendous increase in boat angler effort, the number of steelhead harvested by boaters in 1979 almost equalled the alltime high established in 1978. This, despite the fact that it took an average of 7 hours longer to catch a steelhead in 1979 than in 1978 (Table 14). Due mainly to the closure of the "Hatchery Point" at the North Fork-main Clearwater confluence, harvest by shore anglers dropped significantly in 1979. The 54,874 hours expended by shore anglers in 1979 was 13,000 less than the record established in 1978, but was still over five times the previous high of 10,587 in 1973, Only one-third as many steelhead were harvested by shore anglers in 1979 as in 1978, but 1979 harvest was still more than triple the previous high of 600 harvested in 1973 (Table 14).

The proportion of effort expended by boat anglers returned to a more "normal" level of 51% in 1979 after comprising only 38% **in** 1978. The tremendous concentration of shore anglers on "Hatchery Point" in 1978 was mainly responsible for the imbalance in proportion of shore angler effort (62%) (Table 15).

Resident anglers accounted for 80% of the 4,173 angler interviews conducted during the 1979 spring steelhead season (Table 16). Nonresidents comprised 19% of our interviews in 1979 compared to 13% **in** 1978, Nez Perce tribal members accounted for less than 1% of the interviews both years. Of the nonresident anglers interviewed, 73% lived in Montana, 23% **in** Washington, and 4% in other states (Table 16). We found that 87% of the shore anglers interviewed used bait, 12% used artificial lures and 1% artificial flies. Of the boat anglers interviewed, 71% used bait, 28% lures and 1% flies.

1979 Wild Steelhead Escapement

During the 1978-1979 fish run, we estimated that approximately 6,400 wild steelhead entered the Clearwater drainage. We arrived at this figure by combining the total hatchery returns to Dworshak and Pahsimeroi Hatcheries (12,750) and then substracting the hatchery fish from the final Lower Granite count (27,000) for the fish-year. The remaining 14,250 steelhead we assumed wild, and then relied on historical figures and downstream survival statistics to determine the Clearwater River contribution. Assuming 45% of the wild steelhead escapement over Lower Granite originated from Clearwater stocks (drought conditions in 1977 reduced the return of 1-ocean wild fish returning to the Salmon River), then approximately 6,400 wild fish entered the Clearwater River system.

Census information gathered during the fall and spring seasons indicated that steelhead anglers captured an estimated 210 wild fish, Therefore, our estimate for wild fish escapement to the upper Clearwater and tributaries is 6,200, The 1979 escapement estimate was slightly higher than the previous estimate in 1978 because of the reduced harvest resulting from the catch-and-release regulations during the 1978 fall fishery (Fig.6),

1979 Dworshak Hatchery Return

Workers at Dworshak Hatchery reported that 4,940 adult summer steelhead returned during the 1979 spawning operations. We estimated anglers harvested 4,610 hatchery steelhead in the lower Clearwater and North Fork during the 1979 spring fishery. Therefore, a total of approximately 9,550 Dworshak steelhead returned to the Clear-

Table 14. Angler effort, catch and catch rates during the spring steelhead season (January-April) on the lower Clearwater River, 1970-1974, 1978, and 1979.

Year	Boat anglers			Shore anglers		
	Hours	Catch	(H/F)	Hours	Catch	H/F
1970	8,171	282	28.98	6,324	47	134.5
1971	7,432	390	19.1	5,120	113	45.3
1972[a]	323	12	26.9	1,020	25	40.8
1973[b]	12,114	1,064	11.4	10,587	600	17.7
1974	8,490	723	11.7	5,706	252	22.6
1978[c]	42,093	2,774	15.2	68,071	6,190	11.0
1979[d]	57,786	2,545	22.7	54,874	2,064	26.6

[a]spring steelhead season closed 29 February 1972
[b]Season closed 15 March 1973
[c]Season closed 16 April 1978
[d]Season opened 20 January and closed 30 April 1979

Table 15. Proportion of total effort and steelhead harvest estimated during spring steelhead seasons, 1970-1974, 1978 and 1979.

Year	Percent of effort by		Percent of harvest by	
	Boat anglers	Shore anglers	Boat anglers	Shore anglers
1970	56	44	86	14
1971	59	41	78	22
1972	24	76	32	68
1973	53	47	64	36
1974	60	40	74	26
1978	38	62	31	69
1979	51	49	55	45

Table 16. Summary of angler interviews during the 1979 spring steelhead season on the lower Clearwater River.

	Number	'Percent
Angler interviews		
Residents	3,365	80
Nez Perce Indians	30	1
Non-residents	778	19
Montana	576	73
Washington	181	23
Other states	30	4
Angling methods		
Shore anglers	1,723	46
Bait	1,502	87
Lures	217	12
Flies	4	1
Boat anglers	2,015	54
Bait	1,424	71
Lures	589	28
Flies	2	1
Steelhead checked		
Area I	25	4
Area II	175	25
Area III	313	45
Area IV	178	26

water drainage. This estimate represents 35% of the Snake River escapement (Lower Granite) and approximately 60% of the 15,960 summer steelhead which entered the Clearwater (Table 9).

The 1979 hatchery return at Dworshak was similar to the 1973-1974 return (Table 9). However, due to better fishing conditionsand a slightly longer spring season, anglers harvested twice as many hatchery fish in 1979 as in the spring of 1974. In 1974 and 1978 the hatchery proportion of the Clearwater run reached 70% or higher, but the 1979 return still exceeded the previous 6-year average of 58%.

Department personnel measured 650 adult steelhead of hatchery origin based on marks and fin deformities from anglers creels during the 1979 spring season. The average fork length for steelhead measured in the sports catch was 84.8 cm (33.4 in). As was the case in 1977-1978, the percentage of smaller, 1-ocean, >73.6 cm (>29 in), in the catch was quite low (4.9%) in 1979. However, the 3-ocean age-group showed stronger than usual in 1979. We measured 14.4% of the steelhead at greater than 91.4 cm (36.0 in). This group of larger 3-ocean fish was expected since the returns in 1977 and 1978 indicated that survival of the 1975 Dworshak release was exceptionally high. The length frequency of adults measured in the 1979 spring harvest was slightly tri-modal (Fig. 13).

A total of 4,366 adults were measured during spawning operations at Dworshak Hatchery in 1979. Workers measured each fish to the nearest 25 mm (0.1 in) in fork length. The 3,423 adults sampled during spawning consisted of 1,126 males (33%) and 2,297 females (67%). In addition, the lengths of 943 surplus adults were recorded prior to their transportation into several Clearwater tributaries. The average length for returning adults in the 1979 spawning run was 86.4 cm (34.0 in). This average appears the largest in the history of the hatchery. The percentage of 1-ocean fish was 5.6% similar to the sports catch. The 2-ocean percent was 84.8% and 3-ocean adults at 9.6%. The length frequency for returning adults to the hatchery was nearly identical to the sports catch sample (Fig. 13).

The 3-ocean age group which returned **in** 1979 completed the return (1.6%) from the most successful release in the hatchery's history. According to our return estimates, 28,180 adults have returned from the 1975 release of 1,761,900. It marks the first return which surpassed 1% at Dworshak Hatchery (Table 10). The health of the released smolts, their average size and the 1975 downstream migratory conditions obviously combined to produce a highly successful return. Detailed analysis of these factors and conditions should help provide guidelines for future management programs at Dworshak Hatchery.

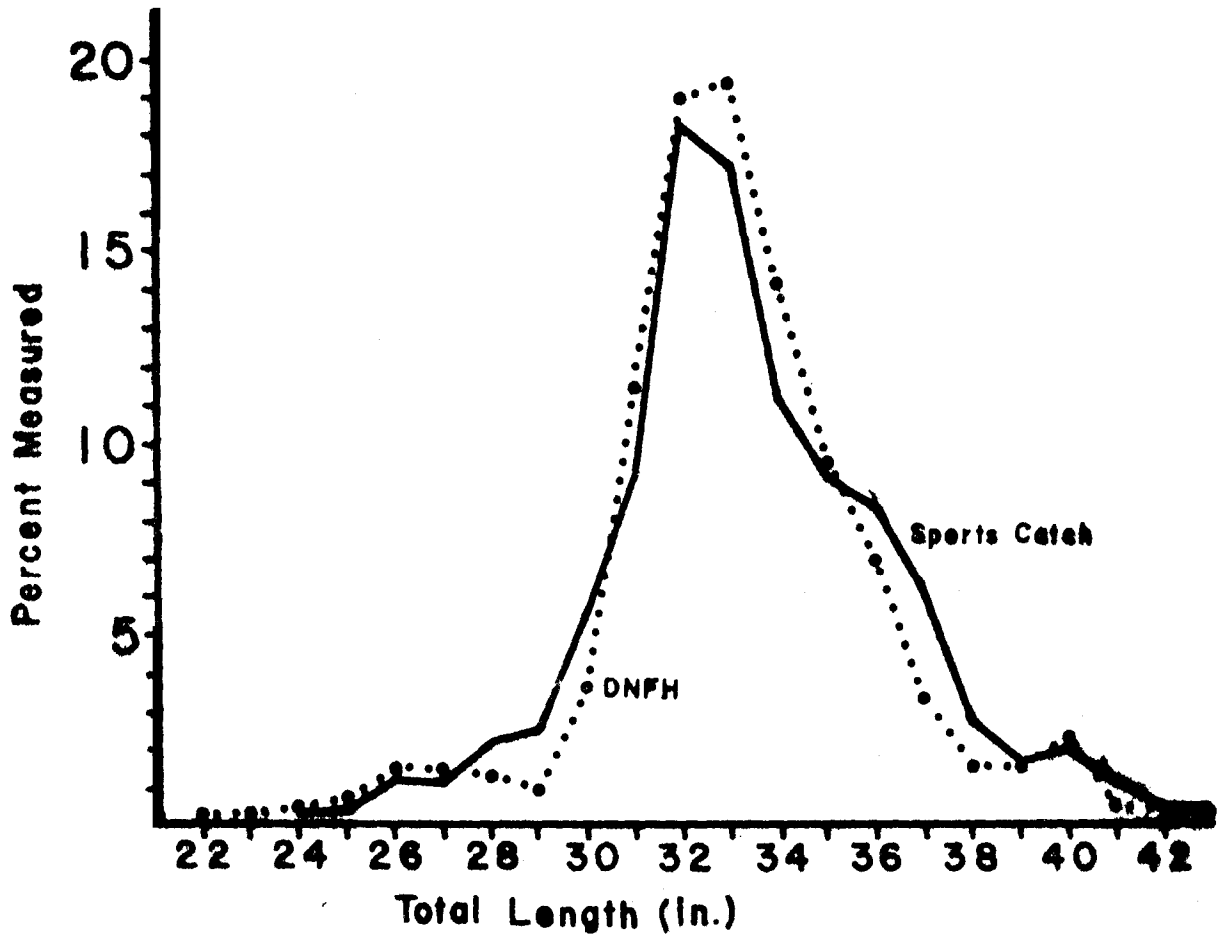

Figure 13. The length frequency distribution of adult, summer run hatchery fish returning to Dworshak Hatchery and from hatchery fish measured in angler's creels during the spring season, 1979. The sports catch sample was 650 and the sample taken at DNFH was 4,366

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